

# KIRTLANDS WARBLER...

recovery plan



KIRTLAND'S WARBLER

RECOVERY PLAN

Prepared by

Kirtland's Warbler Recovery Team

1976

Updated

1985



## *Kirtland's Warbler Recovery Team*

JOHN BYELICH, *Leader*  
Mio, MI  
MICHAEL E. DeCAPITA  
U.S. Fish and Wildlife  
Service  
East Lansing, MI

GEORGE Wm. IRVINE  
U.S. Forest Service  
Cadillac, MI  
ROBERT E. RADTKE  
U.S. Forest Service  
Milwaukee, WI

NELS I. JOHNSON  
Michigan Department  
of Natural Resources  
Roscommon, MI  
WESLEY R. JONES  
Shell Lake, WI

HAROLD MAYFIELD  
Toledo, OH  
WILLIAM J. MAHALAK  
Michigan Department of  
Natural Resources  
Roscommon, MI

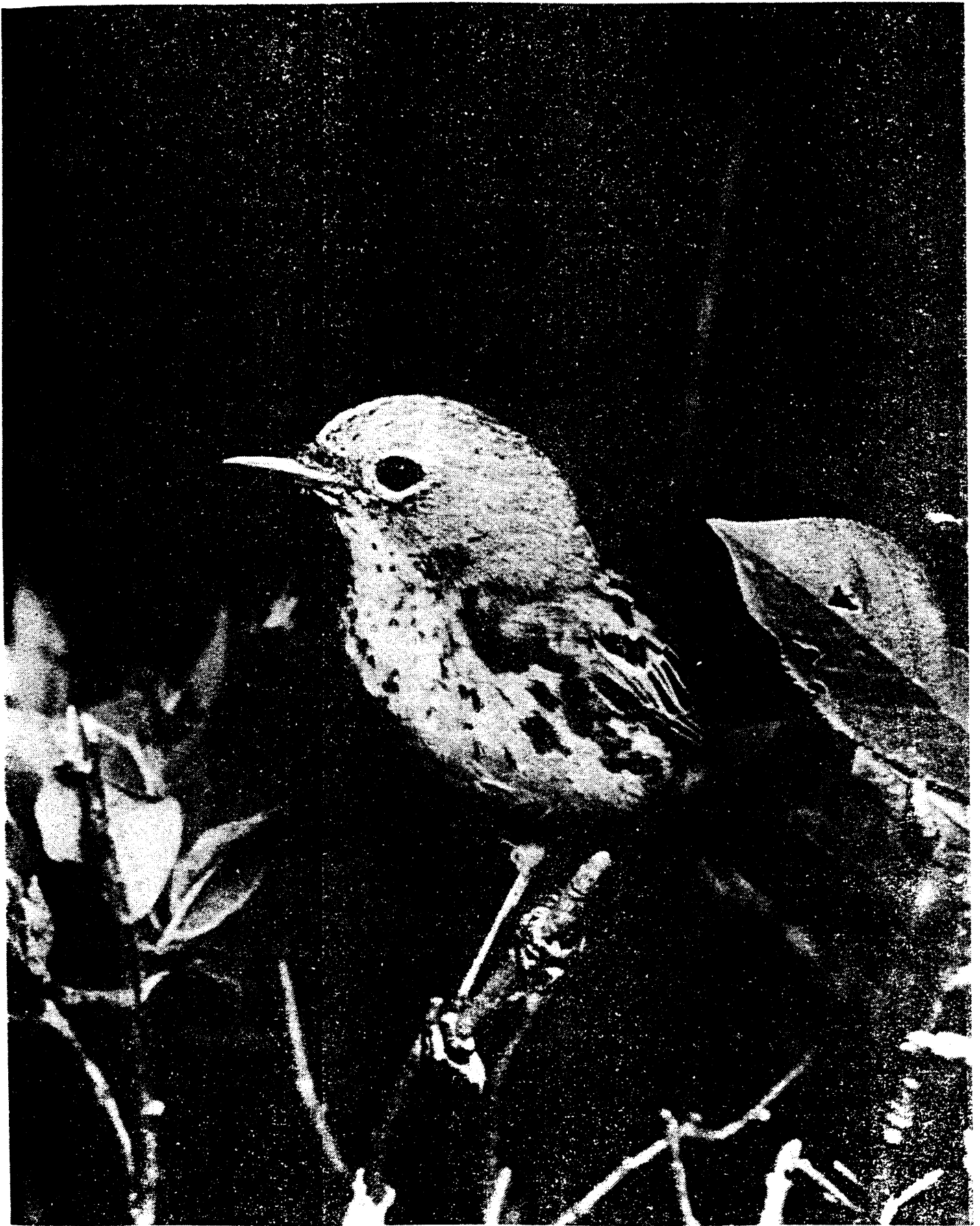


PHOTO: DOW CHEMICAL

# KIRTLAND'S WARBLER RECOVERY PLAN

## TABLE OF CONTENTS

	<u>Page</u>
FOREWORD . . . . .	iv
PART I - Introduction . . . . .	1
Past and Present Distribution . . . . .	4
History of Organized Efforts at Management . . . . .	5
Nesting Habitat . . . . .	7
Wintering Grounds and Migration . . . . .	9
Limiting Factors . . . . .	12
PART II - The Recovery Plan . . . . .	14
A. - Recovery Plan Objectives . . . . .	14
B. - Recovery Plan Outline . . . . .	15
C. - Narrative . . . . .	18
D. - Literature Cited . . . . .	30
PART III - Schedule of Priorities, Responsibilities, and Costs. .	32
APPENDIX	
A. Research Needs . . . . .	41
B. Summary - Habitat Management Plan . . . . .	49
C. Description and List of Essential Habitat . . . . .	50
D. Desirable Habitat for Acquisition . . . . .	75

## FOREWORD

This is an updated Kirtland's Warbler Recovery Plan. It has been approved by the Fish and Wildlife Service, U.S. Department of Interior. The Kirtland's Warbler Recovery Plan has been prepared by the Kirtland's Warbler Recovery Team, under the direction and guidance of the U.S. Fish and Wildlife Service.

The Plan provides goals and objectives for the management of the Kirtland's warbler. Goals and objectives will be attained and funds expended contingent upon appropriations, priorities and other budgeting constraints.

The Plan does not necessarily represent official positions or approvals of cooperating agencies. The Plan does provide direction for achieving the objectives of the Endangered Species Act. Specific habitat objectives, to meet the goals defined in the Recovery Plan, are contained in the "Management Plan for Kirtland's Warbler Habitat in Michigan", prepared by the Huron-Manistee National Forest in cooperation with the Michigan Department of Natural Resources.

Additional copies of the Recovery Plan may be obtained from:

Fish and Wildlife Reference Service  
1776 E. Jefferson St. 4th Floor  
Rockville, MD 20852  
800-582-3421

Approved: \_\_\_\_\_

*Harvey K. Nelson*  
Regional Director,  
U.S. Fish and Wildlife Service  
Twin Cities, Minnesota

Date: \_\_\_\_\_

SEP 30 1985

## ACKNOWLEDGMENTS

There were a number of people who contributed significantly to revising this plan. Included were Dr. Paul Aird, Faculty of Forestry, University of Ontario; Dr. Lawrence Walkinshaw, a student of this species since 1930 and author of numerous papers and a book on the species; Dr. Lawrence Ryel, Jerry Weinrich, Ray Perez, Dr. Sylvia Taylor, and Gary Boushelle, all biologists with the Michigan DNR; Ron Refsnider, James Engel, Craig Faanes and Len Schumann, biologists with the U.S. Fish and Wildlife Service; Bill Jarvis and Dr. John Probst, biologists with the U.S. Forest Service, and Greg Huntington, Michigan Department of Military Affairs. Clerical support was provided by Mary Huhn and Sharon Perkins of the Michigan DNR, and Beverly Hay, Forest Service.

# KIRTLAND'S WARBLER RECOVERY PLAN

## PART I

### INTRODUCTION

The Kirtland's warbler, Dendroica kirtlandii, was first discovered in 1851 when a spring migrant was taken near Cleveland, Ohio. Five more spring migrants (four in Ohio and one in southern Michigan) were collected before the first wintering bird was collected on January 9, 1879, on Andros Island, Bahamas. Between 1884 and 1897 there were 71 specimens collected throughout the Bahamas. Until recently this species had never been found outside the Bahamas in winter, except for an unconfirmed report of two being observed near Veracruz, Mexico, in November 1974. Recent searches, however, have expanded the known winter range to a number of other Caribbean Islands.

Over a half century after the species was first described, its nesting range was discovered. A specimen collected on June 13, 1903, near the AuSable River in western Oscoda County, Michigan, was taken to Norman A. Wood, curator of birds at the University of Michigan Museum of Zoology, who identified it as a Kirtland's warbler. Wood promptly set out on a trip to Oscoda County, traveling by rail, rowboat, buggy and foot to search for nesting birds. Between July 2 and 7 he discovered two small groups of warblers which he described as "colonies" near Butler Bridge (now Parmalee Bridge) in "jack pine plains," but found no nests. On July 8, 1903, Wood moved to a jack pine plain further to the west, and in the western part of Section 31, T27N, R1E, Oscoda County, he found the first nest.

Singing males and migrants have been found in other parts of the Great Lakes Region, but nowhere other than Michigan has a nest been found. Searches for nesting birds were initiated in Canada in 1977 and Wisconsin in 1978 and expanded to Minnesota in 1979.

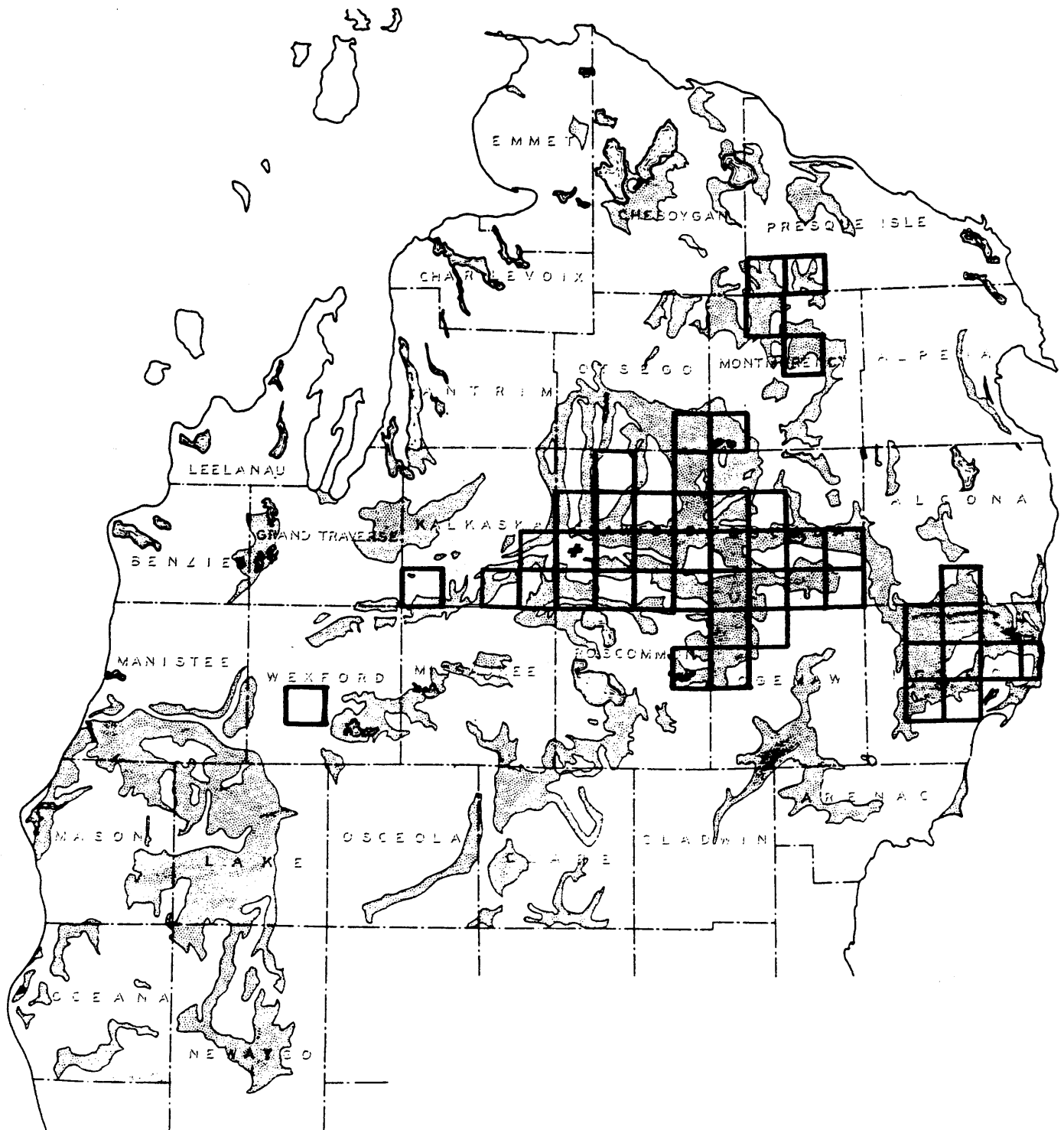
No serious attempt to estimate its numbers was made until 1951. At that time, on the hundredth anniversary of its discovery, it became the first songbird in the world to have its entire population censused. Several groups of ornithologists working in cooperation visited all the suitable habitat within the known nesting range and counted the singing males. Four hundred thirty-two males were found. The number of females was judged to be about equal to the number of males, and so the total population was put in the neighborhood of 1,000 birds (Mayfield, 1953).

Nest observations during the 1940's and 50's showed that the production of young was so low as to raise doubts that the species could maintain itself. However, a repeat census in 1961 revealed 502 males. Hence, the total population was still in the vicinity of 1,000 birds (Mayfield, 1962).

The third decennial census, taken in 1971, confirmed the dire predictions of the previous decade. The count showed a 60 percent decline to 201 singing males (Mayfield, 1972a). The population was down from about 1,000 birds to about 400. Immediately the frequency of the censuses was stepped up to yearly, and the count from 1971 to present has been remarkably level, although with a moderate, but temporary, decline in 1974 and 1975. (Mayfield, 1973a, 1973b, 1960; Ryel, 1984).

Figure 1

# FORMER STATUS OF KIRTLAND'S WARBLER NESTING RANGE IN MICHIGAN (since 1951)






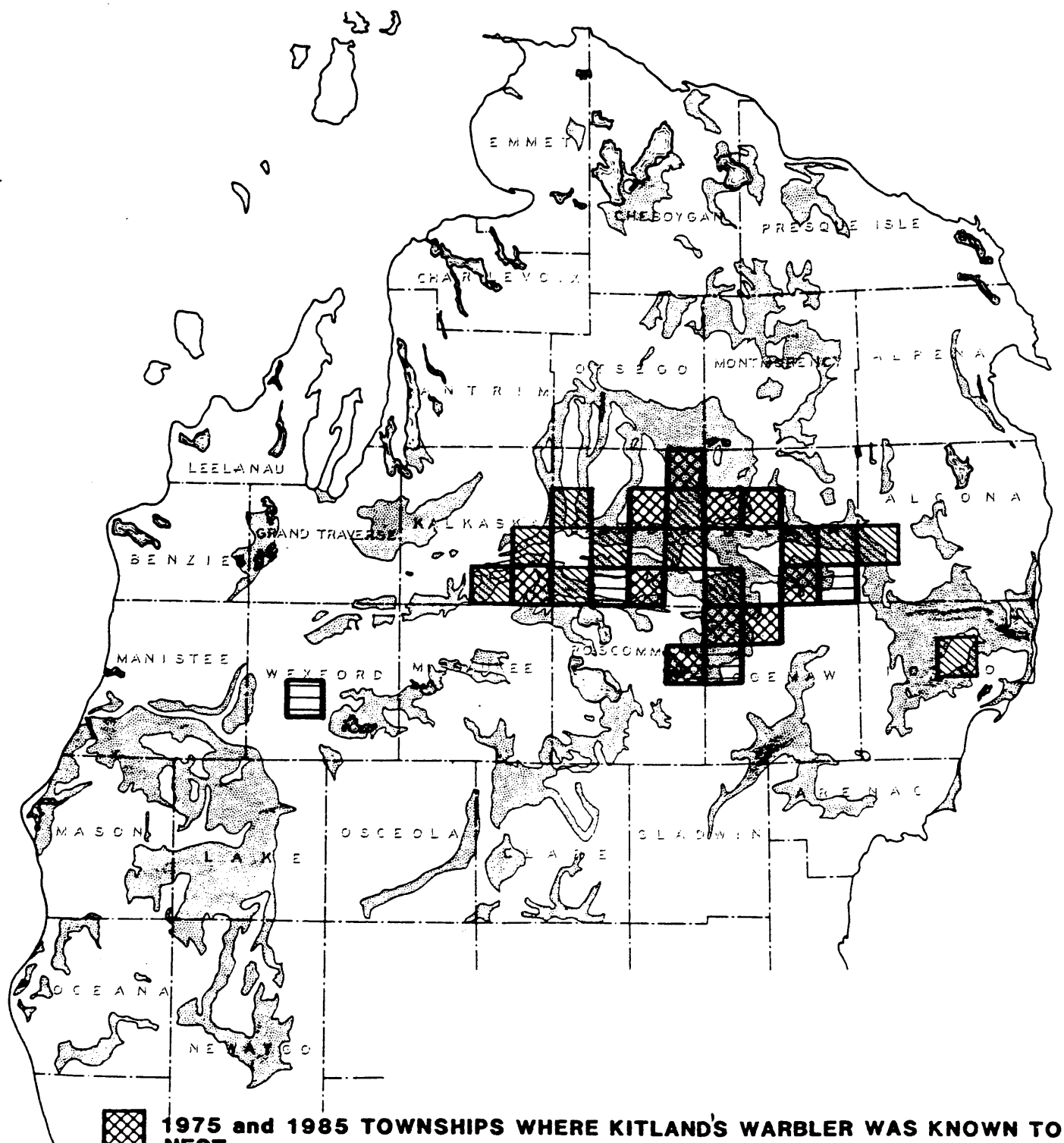
-  DISTRIBUTION OF GRAYLING SAND TYPE SOIL
-  1951 - 1984 TOWNSHIPS WHERE KIRTLAND'S WARBLER NESTED
-  NO RECORDS IN THIS TOWNSHIP



Figure 2

# CURRENT STATUS OF KIRTLAND'S WARBLER NESTING RANGE





In migration the bird travels a fairly direct route between its nesting and wintering ranges, entering and leaving the continent at the coast of North and South Carolina (Mayfield, 1960).

Until 1985 the wintering range of the Kirtland's warbler was believed to be limited to the Bahama Islands. Between September and April the bird had never been seen anywhere else, except for one uncorroborated sighting on the east coast of Mexico (Lane, 1975). In the 1880's and 1890's specimens were taken on nearly all the larger islands in the Bahama group, and there have been many subsequent chance sightings by tourists. Ongoing surveys added Grand Turk Island, South Caicos Island and Hispaniola to the lists of known locations of the Kirtland's warbler. It has been extremely difficult, however, to find the bird in recent years. As a result, little information about its wintering behavior and habitat requirements is available. Apparently, it occupies dry, low broad-leaved scrub which is the prevailing vegetation type on large areas of many of the islands in that region (Radabaugh, 1974; Faanes, unpublished data).

Surveys made in the Bahamas, the adjacent Grand Turk and Caicos Islands and Hispaniola (Dominican Republic) from January through April 1985, located a total of 11 Kirtland's warblers. These birds were mostly found to be associated with desert-like vegetation of deciduous shrubs. This species may also winter in similar habitats found in nearby Cuba.

#### History of Organized Efforts at Management

The first major effort to provide breeding habitat for the Kirtland's warbler was made in 1957. Three areas, each approximately four miles square, were established specifically as warbler management units on state forest land in Ogemaw, Crawford and Oscoda counties (Radtke and Byelich, 1963; Mayfield, 1963). Portions of two of the areas were planted with jack pine, using a special configuration to provide openings within the stand. The intention was to maintain these tracts in three age classes, seven years apart, by burning and replanting the stands when they reached an age of 21 years. Planting of the third area in Oscoda County was held in abeyance because pines on that area were approaching a commercially harvestable age. Almost one-third of this tract was burned by a wildfire in 1964. Regeneration which resulted because of that fire has provided nesting habitat for the past several years.

In 1960, the Forest Service began working on a management plan for the Kirtland's warbler. This plan was approved in 1962, and a 4,010-acre tract was dedicated in June 1963. The plan established 12 management blocks of about 320 acres each in the Mack Lake Area, Oscoda County. Ultimately, each block was to be grown on a 60-year commercial rotation with five years age difference between blocks (Mayfield, 1963).

In addition, in 1973 and 1974, the Huron National Forest cut, burned, and planted areas near Luzerne, Oscoda County, and Tawas, Iosco County, for the benefit of the warbler.

The 60 percent decline in nesting warblers indicated in the 1971 census resulted in a joint meeting of the USDA-Forest Service and Michigan Department of Natural Resources. A major result of this meeting was the formation of a Kirtland's warbler Advisory Committee whose charge was to outline needed habitat research, propose restrictions on human activity in nesting areas, initiate a cowbird control program, and locate funding. One outcome of the meeting was a program begun in the spring of 1972 to reduce cowbird parasitism by trapping and removing cowbirds from the principal nesting areas of the Kirtland's warbler. The major agency in this effort was the U.S. Fish and Wildlife Service. Other contributors were the Michigan Department of Natural Resources (MDNR), Michigan Audubon Society, and U.S. Forest Service (USFS).

Systematic cowbird trapping in 1972 was an outstanding success. Nesting studies on selected tracts showed virtually no parasitism of warbler nests and an unprecedented yield of young warblers per pair of adults. Immediately, habitat improvement was initiated by the State and Forest Service in areas outside established management areas.

In 1973 and 1974, the cowbird control program was expanded so that now virtually all nesting areas of the Kirtland's warbler receive cowbird control. Thus, the program to increase Kirtland's warbler production by reducing cowbird parasitism has been an unqualified success. While it has not, as yet, caused a substantial increase in the spring population, at least the downward slide has been checked.

Efforts on behalf of the Kirtland's warbler were given a giant thrust forward when the Endangered Species Act of 1973 became law (P.L. 93-205). This Act not only officially declared the bird "endangered", it also provided for acquisition of land to increase available habitat, funding to carry out additional management programs, provisions for state cooperation with the Federal Government and establishment of various legal protections for endangered species. While it was the most encompassing endangered species legislation to date, previous Acts in 1966 and 1969 (P.L. 89-669 and P.L. 91-135, respectively) had provided for some endangered species listings, research, and habitat acquisition.

The Federal Endangered Species Act was supplemented by the Michigan Endangered Species Act of 1974 (P.A. 203, 1974). This act provides added legal protection to listed species.

Rules promulgated under the Endangered Species Act of 1973 called for the establishment of Recovery Teams to assist the Fish and Wildlife Service in carrying out provisions in the Act. In early 1975, a Kirtland's Warbler Recovery Team was named by the Secretary of the Interior to guide efforts in aiding the warbler. As a result of efforts by the Team, a Kirtland's Warbler Recovery Plan (Byelich, et al, 1976) was prepared outlining steps designed to increase the species' population.

An intensive habitat management plan was developed by the USFS and MDNR to implement the nesting habitat management phase of the Recovery Plan. In this plan, all of the potential Kirtland's warbler nesting habitat within the former range of this species was identified. Where feasible, this habitat was placed in management units where treatments were scheduled at ten-year intervals to provide sustained nesting habitat conditions within each unit. Work has been progressing at a rate slower than that called for under the Plan. Problems unforeseen when the plan was drafted, such as weak timber markets, limitation on burning, weather and equipment limitations, have inhibited progress.

Research to investigate post-fledging behavior and habitat use, as well as species biology on the wintering ground, has recently been initiated. This intensive effort is expected to provide new and important insights into these virtually unknown facets of Kirtland's warbler biology.

### Nesting Habitat

It became apparent to the early observers of the Kirtland's warbler that these birds were always associated with the areas of the northern Lower Peninsula of Michigan commonly referred to as the "jack pine plains" or "barrens". Subsequent studies of the species have shown it to have an extremely close association with a particular "life community" of the jack pine type.

Jack pine is found on the North American continent from the Maritime Provinces of eastern Canada west to the upper Yukon Valley in the Northwest Territories, and from the middle of Michigan's Lower Peninsula and mid-Wisconsin north to the continent's tree line. It is in the southern extremity of the jack pine range and on the driest, most rudimentary sand soils of lower Michigan that the Kirtland's warbler has found its niche.

With one or two exceptions all nests have been found on Grayling sand soil. This very poor soil is extremely pervious to water. Thus, in addition to supporting the jack pine and the low, sparse ground cover required by the bird, the capacity of Grayling sand to quickly drain during summer downpours may be important in preventing flooding of nests set in the soil.

Grayling sand occurs in 29 counties of the Lower Peninsula, and its amount corresponds closely with the amount of naturally occurring jack pine in those counties. For example, Crawford and Oscoda Counties have large amounts of Grayling sand soil and have 95,000 acres and 90,000, respectively, of natural jack pine forest (Zimmerman, 1956). These two counties also presently have the greatest number of nesting Kirtland's warblers. A few have been found nesting adjacent to the Grayling sands on Graycalm, Deer Park, Rubicon and Croswell sands. There are also records of nesting on two isolated areas where jack and/or red pine had been planted on severely eroded Kalkaska sands.

Although the reasons are not completely understood, the burning of a jack pine site prior to its regeneration appears to be a highly significant, if not necessary, factor for the optimal use of a stand for nesting. Burning may have some subtle effects on the soil and plant community that have yet to be detected. Observations to date show that recent fire has been a factor on nearly all sites where warblers have been known to nest successfully. In recent years, Kirtland's warblers have been found nesting in jack pine stands that were regenerated without fire. However, density of nesting birds is one-half or less than found in burned habitat.

The jack pine stand is used for nesting only in a certain stage of development. Warblers will start using a stand when the height of the tree reaches 5 to 7 feet (or at an age of 6 to 13 years with the average being 8). Stands less than 80 acres in size are seldom occupied, and nesting success has been found to improve greatly where "colonies" of warblers occupy stands 200 acres and larger.

The density of the stand is usually variable, with dense patches and numerous small openings interspersed throughout. Evenly spaced plantations are used but openings appear to be important. Common associated tree species in these jack pine stands are oaks, aspen, cherry, junberry, and other pines. It appears that the Kirtland's warbler will not use a stand where deciduous species and jack pine approach equal density.

The ground vegetation consists of plants that can survive fire, drought, and thermal extremes. These are mostly low shrubs and deep-rooted perennial herbs. The density varies from sparse areas, with bare ground exposed, to quite dense patches of vegetation. In fact, there is usually a mosaic of sedges, shrubs, grasses, and forbs. Warblers require ground cover to conceal the nest site, with mixed blueberry and grass areas being favored locations. However, nests are occasionally found where the ground cover is sparse.

The Kirtland's warbler will continue to nest in jack pine stands as long as the trees retain living branches near the ground. Depending on the density of the trees, low branches no longer exist when jack pine reaches a height from 16 to 20 feet (usually at age 21 in Michigan). When this occurs, the structure of the habitat is apparently no longer acceptable to the warbler for nesting.

Like all forest types, there are sequential changes throughout the various stages of these jack pine stands. Immediately after the old stand has been removed through cutting and/or burning, those bird species adapted to open conditions will occupy the site. Representative species include the common nighthawk, vesper and field sparrow, prairie warbler, sharp-tailed grouse (if in adjacent areas), and upland sandpiper. Where there are snags to produce cavities, the Eastern bluebird, tree swallow, northern flicker, and other open area cavity-nesters are common. As the new stand of jack pine takes form and the lower pine branches begin to touch, the "open" species decline and the "intermediate" species move in. These include the clay-colored sparrow, hermit thrush, and the Nashville and Kirtland's warblers (along with other species). As the stand continues to develop, the community changes. At about the stage where the lower branches thin out and the warbler leaves, the stand then becomes usable by other species such as the spruce grouse and whip-poor-will. When the stand moves into the "old-age" form, inhabitants include the woodpeckers, cuckoos, and other arboreal species. Of course, the more adaptive species such as the American robin, blue jay, black-capped chickadee, and brown thrasher will be found in all stages of this community.

Kirtland's warblers have occasionally been found to nest in red pine plantations. Apparently, planted red pine sometimes creates an acceptable environment. However, in most cases, the warblers have moved into the red pine from an adjacent jack pine habitat. In other circumstances where this species has used habitats such as red pine plantations, or on soils other than Grayling sand, they apparently have moved from adjacent "typical" habitats.

#### Wintering Grounds and Migration

Little is known of the wintering grounds or migration route of the Kirtland's warbler. Although this songbird spends approximately four months (May-August) on the nesting range and eight months on its known wintering range in the Bahamas, information about its wintering behavior and habitat requirements is very scanty. It is possible that factors on the wintering grounds at times may tend to limit the population of this species. Survival of the Kirtland's warbler may depend upon protection of its wintering range, as well as its nesting habitat.

The wintering grounds of the Kirtland's warbler were known long before the discovery of its nesting area. During the late 1800's a number of collectors took specimens of the Kirtland's warbler in the Bahama Islands (Mayfield, 1960). The first Kirtland's collected in the Bahamas was from Andros in 1879 (Mayfield, 1960).

Some 71 museum specimens are known to have been collected from the Bahama Islands. Most (66 of 71) were collected prior to 1900 from more than ten different islands (Mayfield, 1960). Radabaugh (1974) and Walkinshaw (1983) summarize the winter records of known collections and sightings in the Bahamas since 1879.

Numerous efforts have been made to learn about the wintering habitat of this species with little success. Very little is known about the ecological changes that may have occurred in the Bahamas in the last century. Most of the settlements are located along the shore, with very few areas developed inland because of poor soil and lack of fresh water. Radabaugh reports that the major land use change in the Bahamas has been the cutting of Caribbean pine in three northern islands--Grand Bahama, Great Abaco, and Andros during the period 1956 to 1974. Sightings of the Kirtland's among the Caribbean pine suggest that some portion of the population utilizes this habitat in the winter. Only four islands support Caribbean pine, and extensive logging may have an impact on the Kirtland's warbler.

Most of the wintering records are from the scrub habitats of the Bahamas--where Caribbean pine does not exist. Even on the "pine islands" many of the Kirtland's collected have been in broad-leaved scrub. Some 24 specimens have been taken on islands which lack pine. Mayfield (1972b) concludes that, "the Kirtland's warbler usually inhabits low, broad-leaved scrub in the Bahamas ...it is significant that no one has reported them in the high scrub or coppice, trees 15 feet or more in height, that abound in these islands."

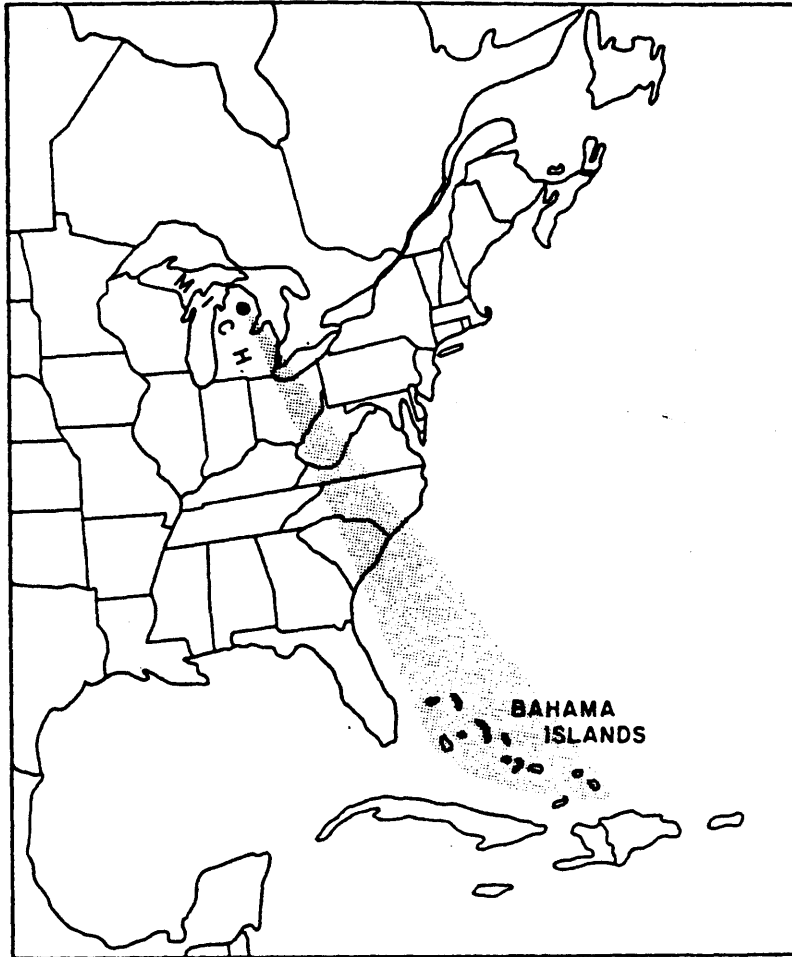
During the first year (1985) of an intensive winter habitat study conducted on a number of Caribbean Islands, eleven Kirtland's warblers were located during the January through April period. One bird was found in Caribbean pine while the remainder were found in dry coppice vegetation - all but one in low coppice. Of potentially great importance is the fact that six of these birds were located southeast of all previous sightings, considerably expanding the known winter range of the species (Faanes, unpublished data). It appears that the Kirtland's may utilize several habitats--including the Caribbean pine ecosystem and the broad-leaf scrub areas.

The Kirtland's warbler leaves its nesting grounds in late August and early September. The latest known Michigan record is September 29, in 1975 (Schempf, 1976), although Kirtland's are usually gone by mid-September. Dates of fall migration records listed by Mayfield (1960:39) range from August 28 (1902) at Oberlin, Ohio, to October 29 (1903) in South Carolina. Fall migration sightings occur mainly in southern Ontario, Ohio, and the South Atlantic states (Figure 3) -- the general direction of the Bahama Islands from central Michigan (Mayfield, 1960:39-40; Walkinshaw, 1983:26-28). The earliest recorded sighting in the Bahamas was August 20, 1970 (Robertson, 1971).

Spring migration records are more numerous and scattered (Mayfield, 1960:40-42). There have been a number of spring sightings in Ottawa County, Ohio, and at Point Pelee, Ontario, in the western Lake Erie region, but other records, some very recent, include Minnesota, Wisconsin, northern Illinois, Indiana, eastern Missouri, Ontario and Quebec (Walkinshaw, 1983:18-22). Observations (Walkinshaw, 1983) of unmated singing males during 1978, 1979, and 1980 in Jackson County, Wisconsin, one in 1977 and 1978 in Renfrew County, Ontario, one in 1978 in Quebec just north of Ottawa, and one in 1985 in southern Ontario indicate that some returning spring migrants tend to miss the primary Michigan breeding area. This may reflect faulty navigation, innate dispersal behavior, or even a return to ancestral nesting areas. The earliest arrival at the breeding ground is May 3 with an average arrival date of May 12 (Mayfield, 1960:42).



**Figure 3**  
**KIRTLAND'S WARBLER MIGRATION ROUTE BETWEEN**  
**WINTERING AND BREEDING GROUNDS**





Contributing factors to the recent Kirtland's warbler decline may be drought and hurricanes. Heavy losses among various species of warblers occurred during the spring migration of 1970-1971, due to drought conditions in the Bahamas and southern Florida.

The Kirtland's migrates north and south through the hurricane zone. During the height of migration, such storms might decimate the population, although this is unlikely since migration extends over several weeks.

Exposure to pesticides along the migration route may occur. In the United States spraying of southern agricultural lands is much more prevalent than on the northern breeding grounds (Mayfield, 1975). However, no known eggshell thinning has been detected or nest mortality attributed to chemical poisoning.

### Limiting Factors

The ultimate limiting factor on the nesting population is the special habitat required. There is persuasive evidence that the amount of such habitat was at maximum during the brief lumbering period when forest fires were rampant in the pinelands during the 1880's and 1890's. The Kirtland's warbler also appears to have been at a peak at that same time. This contention is supported by the large number of specimens taken on the wintering ground during that period.

In modern times, forest fire control has reduced the total acreage burned and also the size of individual burns. These factors have worked to the disadvantage of the Kirtland's warbler. Also, practices that encourage the conversion of jack pine to other species have been detrimental.

Currently, only 4,000 to 5,000 acres are suitable for breeding birds. This is a very substantial reduction from the 10,000 to 15,000 acres available in the 1950's and 1960's and is probably the most important reason for the decline in populations of the Kirtland's warbler.

A second limiting factor is parasitism of Kirtland's warbler nests by the brown-headed cowbird, Molothrus ater. This bird of the prairies reached the Kirtland's warbler nesting range in the late 1800's with the clearing of the forests and the development of agriculture in northern Michigan. This relatively new threat is particularly ominous because the Kirtland's warbler has none of the defenses against cowbird parasitism which are exhibited by many other songbirds. Thus, the cowbird has found the Kirtland's warbler a particularly vulnerable host. Walkinshaw (1972) found that 69 percent of the Kirtland's warbler nests he examined during 1966-1971 were parasitized. Other host species nesting in the same vicinity at that time had a far lower parasitism rate.

Cowbird parasitism has, at times, reduced Kirtland's warbler production by at least 40 percent and in some years has almost completely wiped out the warbler's reproductive effort. It appears almost certain the Kirtland's warbler population cannot endure for long under this extremely heavy burden.

As previously indicated (page 6), removal of cowbirds from a nesting area is beneficial to the production of young warblers in nests. Nesting studies on selected tracts showed virtually no parasitism of warbler nests and excellent production of young warblers per pair of adults (Shake and Mattsson, 1975; Kelley and DeCapita, 1982; Walkinshaw, 1983).

Cowbird control by the Fish and Wildlife Service has continued each year since 1972. About 45,000 cowbirds were removed from 1972 through 1984. Monitoring studies of nesting birds from 1972 through 1981 showed continuing effectiveness in restoring the reproductive capability of the species to what it must have been before the cowbird arrived (Mayfield, 1975; Shake and Mattsson, 1975; Walkinshaw and Faust, 1974 and 1975; Orr, 1975; Kelley and DeCapita, 1982; Walkinshaw, 1983).

Annual censuses from 1972 through 1985 have revealed stabilization of the breeding population at approximately 200 pairs. Without cowbird control, the Kirtland's warbler population would significantly decline.

Third, although nesting Kirtland's warblers have been studied extensively, little is known of their ecology after fledging but prior to fall migration. Some limiting factors, such as excessive predation, may be in effect during this period. Research efforts should be undertaken to improve knowledge of the immediate post fledging period.

Fourth, there may be limiting factors, as yet unidentified, on the wintering ground. Since 1972, about 800-900 warblers have gone south each fall, but only about 400 have been found in the census in Michigan the next June. This could indicate that some returning birds cannot find territories because of limited breeding habitat. Also, this could indicate that one-half of the fall population is lost on the winter range or during migration, but we have no direct evidence of the cause; nor do we know if this is an excessive overwinter mortality rate for this bird. All hypotheses to explain the situation -- dry weather, increasing competition for food with other species of warblers, hurricanes and development in the Bahamas -- have not been researched to date. An immediate and intensive effort should be made to investigate the ecology of the Kirtland's warbler during migration and on its winter range.

## Part II

### RECOVERY

#### A. RECOVERY PLAN OBJECTIVES

THE PRIMARY OBJECTIVE OF THE PLAN IS TO REESTABLISH A SELF-SUSTAINING KIRTLAND'S WARBLER POPULATION THROUGHOUT ITS KNOWN RANGE AT A MINIMUM LEVEL OF 1,000 PAIRS. ATTAINMENT OF THIS OBJECTIVE WILL ALLOW THE SPECIES TO BE REMOVED FROM THE ENDANGERED SPECIES LIST. SECONDARY OBJECTIVES, DESIGNED TO ACCOMPLISH THE PRIMARY OBJECTIVE, ARE AS FOLLOWS:

1. Manage 127,600 acres for the Kirtland's warbler. Encourage management on private lands.
2. Protect the Kirtland's warbler on its wintering grounds and along the migration route.
3. Reduce key factors adversely affecting reproduction and survival of Kirtland's warbler.
4. Monitor breeding populations of the Kirtland's warbler to evaluate responses to management practices and environmental changes.
5. Develop and implement emergency measures to prevent extinction.

## B. KIRTLAND'S WARBLER RECOVERY PLAN OUTLINE

1. MANAGE 127,500 ACRES OF STATE AND FEDERAL LANDS FOR THE KIRTLAND'S WARBLER. ENCOURAGE MANAGEMENT ON PRIVATE LANDS.
  - 1.1 Implement the "Management Plan for Kirtland's Warbler Habitat in Michigan". (Appendix B)
    - 1.11 Protect existing essential habitat.
      - 1.111 Fire control.
      - 1.112 Insect and disease control.
    - 1.12 Improve occupied and developing habitat.
    - 1.13 Establish new habitat.
    - 1.14 Revise and update "Management Plan for Kirtland's Warbler Habitat in Michigan."
  - 1.2 Provide technical assistance for private land management.
  - 1.3 Manage lands on the Camp Grayling Military Reservation for the Kirtland's warbler.
  - 1.4 Acquire key tracts to meet habitat management objectives.
  - 1.5 Provide information and educational services to the public.
  - 1.6 Meet research needs. (See Appendix A)
  - 1.7 Evaluate and monitor habitat management activities.
    - 1.71 Identify stocked areas and areas needing planting and sanitation.
    - 1.72 Improve cultural treatments for habitat development.
2. PROTECT THE KIRTLAND'S WARBLER ON ITS WINTERING GROUNDS AND ALONG THE MIGRATION ROUTE.
  - 2.1 Provide and protect adequate wintering habitat to support the nesting populations (West Indies).
    - 2.11 Locate and monitor wintering populations.
    - 2.12 Protect the Kirtland's warbler and its wintering areas.
      - 2.121 Delineate wintering habitat.
      - 2.122 Establish cooperative programs with other countries to protect wintering habitat of the Kirtland's warbler.

- 2.123 Identify and monitor land use changes on known wintering grounds.
- 2.124 Determine factors affecting wintering mortality of the Kirtland's warbler.
- 2.125 Reduce bird mortality on wintering grounds.
- 2.2 Protect the Kirtland's warbler during migration.
  - 2.21 Define the migration route of the Kirtland's warbler.
  - 2.22 Protect key habitat components along the migration route.
  - 2.23 Eliminate or reduce adverse environmental factors during migration.
- 3. REDUCE KEY FACTORS ADVERSELY AFFECTING REPRODUCTION AND SURVIVAL OF KIRTLAND'S WARBLER.
  - 3.1 Control human activities which may be detrimental to Kirtland's warbler population.
    - 3.11 Provide an information and education program for protection on the breeding and winter range and during migration.
    - 3.12 Provide protection of the Kirtland's warbler and its breeding habitat.
      - 3.121 Protect occupied nesting areas on public lands.
      - 3.122 Develop cooperative agreements with private landowners to reduce conflicting uses.
      - 3.123 Regulate Michigan National Guard use of nesting areas.
    - 3.13 Prevent taking and harassment of Kirtland's warbler as defined in the Endangered Species Act.
  - 3.2 Identify and control factors other than man which adversely affect the Kirtland's warbler.
    - 3.21 Maintain cowbird control.
    - 3.22 Identify and control other predators and parasites.
  - 3.3 Monitor and evaluate all adverse influences and effectiveness of control.

4. MONITOR BREEDING POPULATIONS OF THE KIRTLAND'S WARBLER TO EVALUATE RESPONSES TO MANAGEMENT PRACTICES AND ENVIRONMENTAL CHANGES.
  - 4.1 Determine overall population level on nesting range by counting singing males annually.
  - 4.2 Survey in similar habitats.
  - 4.3 Evaluate census data and prepare reports.
5. DEVELOP AND IMPLEMENT EMERGENCY MEASURES TO PREVENT EXTINCTION.
  - 5.1 Develop captive breeding and release techniques.
  - 5.2 Develop cross-fostering techniques.
  - 5.3 Develop captive wintering techniques.
  - 5.4 Select appropriate sites and implement emergency measures.



## C. NARRATIVE

**PRIMARY OBJECTIVE: REESTABLISH A SELF-SUSTAINING KIRTLAND'S WARBLER POPULATION THROUGHOUT ITS KNOWN RANGE AT A MINIMUM LEVEL OF 1,000 PAIRS.**

The goal is to remove the Kirtland's warbler from the endangered species list. To achieve this requires the management and protection of the bird and its habitat on the nesting grounds in Michigan, on the wintering grounds and during migration, and the reduction of factors threatening survival.

The Recovery Plan describes the actions of various federal, state, and private groups and individuals needed to achieve a viable population of the Kirtland's warbler. Through coordinated efforts this objective can be achieved.

### 1. MANAGE 127,600 ACRES OF STATE AND FEDERAL LANDS FOR THE KIRTLAND'S WARBLER. ENCOURAGE MANAGEMENT ON PRIVATE LANDS.

Potential Kirtland's warbler summer habitat is relatively limited. Pine lands with potential to provide the known nesting requirements occupies about 150,000 acres in Michigan. This area includes all of the sites with potential on State and National Forest lands. An additional several thousand acres of privately owned lands have a potential for supporting the species. At this time, public lands offer the best opportunity for a successful management program. Even though acreage available for summer range development is limited, it is quite adequate to support the goal of 1,000 pairs.

The land manager has a number of options available concerning the distribution and size of harvest, the tree species to favor, and the schedule of harvesting. All of these management options can directly affect the habitat of the Kirtland's warbler. Commercial harvest, special plantings, various stand treatment techniques, together with direct wildlife habitat management for the warbler, offer the most realistic means for meeting the objectives of the Recovery Plan. A coordinated timber-wildlife management plan can achieve the desired nesting habitat objectives. This plan will also provide a continuous supply of forest products.

#### 1.1 Implement the "Management Plan for Kirtland's Warbler Habitat in Michigan." (Appendix B)

The goal is to develop and maintain 38,000 acres of breeding habitat at all times. Areas of state and federal land have been designated in the "Management Plan for Kirtland's Warbler Habitat in Michigan", approved and implemented in 1981.

By sustaining the amount of acreage through a planned rotation, an adequate amount of nesting habitat will be provided to maintain a viable Kirtland's warbler population. This will be most feasibly accomplished through carrying the jack pine to a commercial rotation age.

The first step was to determine, by location and condition, the total acreage of potential Kirtland's warbler breeding habitat in northeastern Lower Michigan. This required the identification of jack pine forest types on Grayling sand soils and the selection of those stands which could be grouped into manageable units. First priority was directed to areas formerly known to provide warbler breeding habitat. This basic inventory and selection of areas for habitat management was done by the U.S. Forest Service and the Michigan Department of Natural Resources on the public lands under their respective jurisdictions, and these agencies will share the task for private lands.

The identification of some 127,500 acres of the Grayling sand jack pine type for management of Kirtland's warbler habitat is, in essence, the identification of these stands for the management of a life community in which there is a rather unique assemblage of species. It is the only known life community where the Kirtland's warbler is adapted to survive.

The management of the dry site jack pine community under the strategy outlined in the Habitat Management Plan will simultaneously provide sustained habitat conditions for a wide variety of plant and animal species, including the Kirtland's warbler, and a valuable wood fiber resource for man.

Maps have been prepared showing jack pine stands on Grayling sand soils by size and density classes. From these maps, the total acreage of manageable units of jack pine with potential for Kirtland's warbler habitat was computed and classified by land ownership. On public lands, areas of potential breeding habitat were located by the use of existing vegetation and soils maps and aerial photographs followed by field examinations.

#### 1.11 Protect existing nesting habitat.

The first priority for habitat management is to protect, improve, and where possible, expand all areas of breeding habitat of manageable size that are now used by Kirtland's warblers. (Refer to 3.1 for protection from human activities).

Every possible effort will be made to ensure maximum potential of presently occupied breeding habitat by protecting it from destruction or degradation. All developments such as campgrounds, ORV trails, highways, etc., will be planned in and near occupied breeding habitat on public lands and vigorously discouraged on private lands.

#### 1.111 Fire control.

Fire management plans call for the vigorous suppression of wildfires which threaten to burn over presently occupied breeding habitat and areas. As additional breeding habitat comes into production, and if the Kirtland's warbler population responds favorably, this practice may be modified in order to use fire management as a habitat development tool. Fire breaks will be established within management areas to contain burns and reduce risks.

#### 1.112 Insect and disease control.

Insects and disease will be controlled. Insects and diseases which may threaten occupied breeding habitat may be controlled if the action can be effected without adverse influence to the breeding population either directly or indirectly. Control actions will be monitored.

#### 1.12 Improve occupied and developing habitat.

The breeding habitat potential of existing stands of jack pine will be fully developed, particularly those adjacent to or within occupied habitat. This work will be done during fall and winter to avoid harassment of breeding warblers. Small openings will be created where necessary and suitable ground level vegetation encouraged by spot burning. Sanitation treatments will be made to remove or eradicate oak stump sprouts or other unwanted hardwood trees and sprouts. Overstory pines or hardwoods will be removed or eradicated.

#### 1.13 Establish new habitat.

Since potential warbler habitat occurs in significant acreages on both State (Michigan Department of Natural Resources) and Federal (USDA--Forest Service) land, and since both these agencies have individual land management functions, each agency is responsible for developing habitat on the land with which it is entrusted. The Habitat Management Plan describes, in detail, each agency's on-the-ground land management program for the development and improvement of nesting habitat until year 2030.

Using the data obtained from the inventory of potential Kirtland's warbler breeding habitat, the USFS and DNR have selected and incorporated into their forest management plans 127,500 acres for warbler management. The goal is to reach 38,000 acres of suitable nesting habitat by 2005, which will support and sustain a breeding population of 1,000 pairs. To reach this goal, approximately 2,550 acres of suitable jack pine will need to be regenerated annually. The time frame could be modified in either direction, as necessary, to keep pace with the anticipated expansion of the total Kirtland's warbler population.

Most jack pine stands that have been identified as essential nesting habitat are to be managed on a 45- to 50-year rotation. These stands will provide nesting habitat between 8 and 22 years of age. The regeneration method will preferably involve prescribed burning. The surest and possibly quickest, but most costly method, is to clearcut, burn and plant seedlings. Another method is to retain seed trees when stands are cut and burn to prepare the site and release seed for natural regeneration. Where natural regeneration fails, planting will be done. In areas where prescribed burning may not be feasible, mechanical site preparation followed by seeding or planting may be used. This is a silvicultural decision to be determined for each site.

The following table is an example of managing the 127,500 acres of jack pine. A fifty-year rotation requires an average of 2,550 acres regeneration per year. A new stand is usually eight years old before warblers start to occupy it. A small number of birds first occupy the site, and their numbers increase rapidly the first three or four years. The population then remains fairly constant for ten years and declines rapidly in the next two years. After a stand reaches 23 years of age, it is usually past the stage that can support nesting warblers. These jack pine stands reach merchantable size for commercial cutting at about age 45.

This table is based on an average population density of one breeding pair per 30 acres during its optimum stage. Thus, in the last column, the estimated population for each year class takes into account a less dense population during establishing and declining stages. The population objective cannot be achieved until 38,000 acres are in developing and optimum stages.

Table 1

<u>Stand Age</u>	<u>Acres Available</u> <u>Each Year</u>	<u>Acres/pair</u>	<u>Est. of br. pairs</u> <u>per stand yr. class</u>
1-7	(regenerating stand	-- too small for occupancy)	
8	2,550	150	17
9	2,550	75	34
10	2,550	40	64
11	2,550	30	85
12	2,550	30	85
13	2,550	30	85
14	2,550	30	85
15	2,550	30	85
16	2,550	30	85
17	2,550	30	85
18	2,550	30	85
19	2,550	30	85
20	2,550	46	55
21	2,550	60	43
22	2,550	120	22
23-50	(maturing stand--too large for occupancy)		

## Sub-Totals:

1-7	17,850	-	0
8-10	7,650	-	115
11-20	25,500	-	820
21-22	5,100	-	65
23-50	71,400	-	0

TOTALS                      127,500                      1,000 pair

Prescribed fire will be the primary tool used to regenerate non-merchantable jack pine stands on poor sites. Areas burned by wildfires will be direct seeded or planted if natural regeneration fails. The removal of "skips" will be accomplished by commercial logging, if possible, and sanitation treatments will be made if needed.

Additional cultural treatments may involve some sanitation treatment to remove excess oak or other deciduous sprouts in regenerated stands. Overly dense stands may be improved by thinning, and fully stocked stands may need scattered openings developed. Such treatments should be made before the stand reaches a height of five feet.

Non-commercial treatments, such as prescribed burning, cutting, rehabilitation of burns, and areas not adequately regenerated, will have to be used as the primary tool for Kirtland's warbler habitat regeneration on poor sites or on areas lacking commercial products because of past history.

- 1.14 Revise and update "Management Plan for Kirtland's Warbler Habitat in Michigan"

The above plan is an extension of the Recovery Plan. As such, and because of continually changing conditions within the areas of identified and potential nesting habitat, periodic revision is required. This will occur upon the completion and approval of the revised Recovery Plan. A management plan will be prepared for lands purchased by the Fish and Wildlife Service.

#### 1.2 Provide technical assistance to private land management.

Although most Kirtland's warbler habitat management will be done on public lands, private landowners will be encouraged to participate, where feasible, utilizing the same basic techniques prescribed for public lands. It may be desirable or necessary, in some cases, to acquire management rights to key privately-owned tracts by purchase or lease. A cooperative program will be developed with private landowners to manage Kirtland's warbler habitat. This may include technical services, tax incentives, and direct habitat improvement with state-owned equipment and manpower. Fire protection will be provided through existing state and Forest Service fire control responsibilities.

#### 1.3 Manage lands on the Camp Grayling Military Reservation for the Kirtland's warbler.

The Michigan Department of Natural Resources is working with the Michigan Department of Military Affairs (DMA) to incorporate suitable lands within the Grayling Military Reservation into the Kirtland's Warbler Habitat Management Plan. The plan will coordinate military activities with habitat needs. The objective will be to resolve conflicts between military operations and habitat management, while meeting the objectives of the Endangered Species Act.

#### 1.4 Acquire key tracts to meet habitat management objectives.

Purchase or lease key tracts for habitat management. Acquire key tracts using Land and Water Conservation Funds, state endangered species funding, donations, or other opportunities.

Key tracts have been identified in the Recovery Plan (Appendix D). They would be acquired only through willing seller - willing buyer. Lands identified for purchase include key tracts within established management areas and those needed to complete habitat management activities, such as prescribed burning. These lands are an essential component of the Recovery Plan.

Lands listed for acquisition in the Recovery Plan are being purchased by the USDA-Forest Service and the U.S. Fish & Wildlife Service. An agreement between the Michigan Department of Natural Resources and Fish and Wildlife Service provides for consolidation of newly acquired lands into a single management block. Jack pine management on this block may be altered to produce Kirtland's warbler habitat on a short-term, non-commercial rotation.

The initial Recovery Plan identified 9,468 acres (7,661 Fish and Wildlife Service and 1,807 Forest Service) of private land within established management areas that should be acquired. To date (June 1985), 3,932 acres have been purchased by the Fish and Wildlife Service and 400 acres by the Forest Service. Continuing efforts are under way to acquire the remaining key lands.

1.5 Provide information and educational services to the public.

An information program will be developed to allow public review and input to the habitat program. A similar effort should also be made to increase awareness and acceptance of the program within the involved agencies.

1.6 Meet research needs.

More knowledge is needed to resolve questions on management and protection of this warbler. A special committee has been established by the Recovery Team to guide and coordinate all research efforts.

Information is needed to refine current knowledge on nesting requirements, wintering habitat, and migration route. A comprehensive list of research needs is included in Appendix A.

1.7 Evaluate and monitor habitat management activities.

A system of surveys will be set up to evaluate the habitat management program. Specific research projects needed to improve the program will be designed. Treated areas will be evaluated to assure that the habitat program achieves its goal of 38,000 acres of nesting habitat by 2005.

1.71 Identify stocked areas and areas needing planting and sanitation.

Stocking surveys of treated areas will be made within three years, and follow-up treatment will be prescribed, if necessary, to obtain adequate regeneration. Prior to the seventh year after treatment, areas will be surveyed to determine any need for sanitation, opening development or overstory removal.

1.72 Improve cultural treatments for habitat development.

Develop improved guidelines for cultural treatments to produce better plant communities most productive as nesting habitat. The effectiveness and cost efficiency of the Kirtland's warbler habitat program can be improved by determining the best cultural treatment, or combinations thereof, which will most consistently create the specific nesting conditions required by the birds.

2. PROTECT THE KIRTLAND'S WARBLER ON ITS WINTERING GROUNDS AND ALONG THE MIGRATION ROUTE.

2.1 Provide and protect adequate wintering habitat to support the nesting populations (West Indies).

2.11 Locate and monitor wintering populations.

Develop a system for reporting sightings of Kirtland's warbler on its wintering grounds with evaluation and follow-up. Develop and use inventory techniques, including radio telemetry. Establish a cooperative winter survey for the Kirtland's warbler.

2.12 Protect the Kirtland's warbler and its wintering areas.

2.121 Delineate wintering habitat.

Determining the wintering habitat of this species will require extensive surveys. The initial step should be to obtain an accurate vegetative and land use map of the wintering grounds. Secondly, high level photos (ERTS, Satellite and Skylab) could be used to obtain cover and land use data. The use of such high tech capability would not only help in identifying the birds' wintering habitat, but would also, in the long run, contribute to their protection.

2.122 Establish cooperative programs with other countries to protect wintering habitat of the Kirtland's warbler.

Develop cooperative programs with foreign countries and international conservation organizations, such as the World Wildlife Fund, to protect the Kirtland's warbler and its wintering habitat. Establish a cooperative agreement between National Audubon Society and Bahamas National Trust to protect the Kirtland's warbler and its habitat.

2.123 Identify and monitor land use changes on known wintering grounds.

Classify and map the vegetation of known historical wintering areas. Map the broad vegetation zones of the Bahamas using ERTS or high level photos.

2.124 Determine factors affecting wintering mortality of the Kirtland's warbler. Carry out necessary research.

2.125 Reduce bird mortality on wintering grounds. Implement measures to diminish factors identified in 2.124.

2.2 Protect the Kirtland's warbler during migration.

Contributing factors to the recent Kirtland's warbler decline may be drought and hurricanes. The Kirtland's migrates north and south through the hurricane zone. During the height of migration, such storms might decimate the population, although this is unlikely since migration extends over several weeks.

Heavy losses among various species of warblers occurred during the spring migration of 1970-1971, due to drought conditions in the Bahamas and southern Florida.

2.21 Define the migration route of the Kirtland's warbler.

Establish procedure to accumulate and verify sighting records of Kirtland's warbler during migration. Initiate research program (radio telemetry) to determine migration route, and identify key sites along the route.



2.22 Protect key habitat components along the migration route. Implement measures to protect sites crucial to successful migration, as identified in 2.21.

2.23 Eliminate or reduce adverse environmental factors during migration.

Determine hazards adverse to Kirtland's warbler during migration. Monitor major weather conditions. Monitor pesticide levels along known migration routes. Monitor effects of high buildings, towers, beacons, and high intensity strobe lights (towers, etc.) on bird mortality.

### 3. REDUCE KEY FACTORS ADVERSELY AFFECTING REPRODUCTION AND SURVIVAL OF KIRTLAND'S WARBLER.

The basic objective of this part of the plan is to physically reduce both human and environmental factors which adversely affect reproduction and survival of Kirtland's warblers.

3.1 Control human activities which may be detrimental to Kirtland's warbler population.

In an effort to reduce human activities on the breeding and winter range and during migration, a basic information and education program should be conducted. Guided tours along with informational material should be provided. All types of media should be used to disseminate information on the need for protecting the Kirtland's warbler and the actions being taken.

An effort should be made to review and coordinate all land use plans in order to avoid conflicts which may be detrimental to the birds.

3.11 Provide an Information and Education Program for protection on the breeding and winter range and during migration.

This will be accomplished through publishing notice of land closures and all other public restrictions in all news media and providing informational material on protection. This will include printed material, audio visual programs, and a film and photo library.

Visitor informational programs will be provided at the field level. Guided tours will be provided on pre-selected routes. Other public information programs (talks, displays, etc.) will be provided to meet public needs.

3.12 Provide protection of the Kirtland's warbler and its breeding habitat.

Protection must be afforded the breeding bird and its habitat by closing State and Federal lands to all conflicting use. Specific attention should be given to limiting military activity on the Michigan National Guard land which holds a large concentration of breeding birds. All public lands should be posted to prevent trespassing and other adverse human activity during the nesting season, such as the playing of tape recorded warbler songs. The first priority for habitat management is to protect, improve, and where possible, expand all areas of breeding habitat of manageable size that are now used by the Kirtland's warblers.

3.121 Protect occupied nesting areas on public lands.

Close State and National Forest lands in the breeding area from May 1 - August 15. Post and enforce regulations on closed lands.

3.122 Develop cooperative agreements with private landowners to reduce conflicting uses.

Encourage cooperative agreement in closure of private lands to conflicting uses. Post and enforce regulations on closed lands.

3.123 Regulate Michigan National Guard use of nesting areas.

Review and revise Cooperative Agreements between public agencies involved.

3.13 Eliminate taking of the Kirtland's warbler as defined in Public Law 93-205.

Develop guidelines on activities which may adversely affect the Kirtland's warbler, including pesticide use. Post and enforce regulations.

3.2 Identify and control factors, other than man, which adversely affect the Kirtland's warbler.

3.21 Maintain cowbird control.

The only factor other than human activity currently known to seriously affect the warbler is nest parasitism by the brown-headed cowbird. Control by trapping has essentially eliminated this threat, and this program will be maintained as long as necessary.

3.22 Identify and control other predators and parasites.

The effect of other predators and parasites is presently uncertain. These effects will be investigated. Control measures will be developed and implemented when necessary and practical. Control measures investigated will include habitat modification.

3.3 Monitor and evaluate all adverse influences and effectiveness of control.

The Kirtland's breeding population shall be periodically monitored, using nest studies, if necessary, to determine if control of adverse factors, including cowbird control, are yielding the desired effect.

4. MONITOR BREEDING POPULATIONS OF THE KIRTLAND'S WARBLER TO EVALUATE RESPONSES TO MANAGEMENT PRACTICES AND ENVIRONMENTAL CHANGES.

4.1 Determine overall population level on nesting range by counting singing males annually.

Annual monitoring of the breeding population is used to evaluate responses to management practices and environmental changes. Overall population levels on nesting range are determined by counting singing males. Doubling the number of singing males gives a close approximation to the total breeding population. Annual summaries of the census data are provided to planners, administrators, managers, and others interested in the status of the species (Table 2).

#### 4.2 Survey in similar habitats.

Survey jack pine stands outside of known nesting range (i.e. Wisconsin, Minnesota, Ontario and Quebec.)

#### 4.3 Evaluate census data and prepare reports. The Michigan DNR will be responsible for coordinating the survey, evaluating data and preparing the reports.

Table 2

#### KIRTLAND'S WARBLER

#### Counts of Singing Males in Michigan by County

<u>County</u>	<u>1951</u>	<u>1961</u>	<u>1971</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
Crawford	142	52	101	72	67	72	81	80
Oscoda	103	152	48	67	72	81	71	80
Iosco	74	30	1	3	1	1	3	7
Montmorency	43	61	1	0	0	2	1	0
Presque Isle	34	34	0	0	0	0	0	0
Roscommon	4	13	0	8	5	1	1	5
Alcona	4	0	0	0	0	0	0	1
Kalkaska	28	32	0	32	17	15	15	21
Ogemaw		114	47	50	44	42	43	22
Otsego		14	3	0	0	0	0	0
Wexford (1973-4; singing males)			0	0	0	0	0	0
<b>TOTAL</b>	<b>432</b>	<b>502</b>	<b>201</b>	<b>232</b>	<b>207</b>	<b>215</b>	<b>215</b>	<b>216</b>
<b>Counties</b>	<b>8</b>	<b>9</b>	<b>6</b>	<b>6</b>	<b>7*</b>	<b>8*</b>	<b>7</b>	<b>7</b>
<b>Sections</b>	<b>91</b>	<b>86</b>	<b>27</b>	<b>46</b>	<b>44</b>	<b>48</b>	<b>49</b>	<b>49</b>

\* Includes Marquette Co., singing males only.

## 5. DEVELOP AND IMPLEMENT EMERGENCY MEASURES TO PREVENT EXTINCTION.

The population of Kirtland's warblers dropped to 167 pairs in 1974, resulting in concern for survival of this species. With such a small remaining population of Kirtland's warblers, it is possible a catastrophic situation could develop that would lower the world's population of Kirtland's warblers to a level from which it would be unable to recover. If the total population of Kirtland's drops below 100 pairs, emergency measures will be initiated to prevent extinction. These measures include cross-fostering, captive wintering, and captive breeding. Research techniques, using surrogate species, need to be developed immediately.

Plans should also be made to effect a reintroduction if the population does not properly respond to current management efforts. Large blocks of jack pine habitat on soil types similar to Grayling sand should be located on cover type maps of the Upper Peninsula of Michigan, and in Wisconsin and Minnesota, and then examined in the field.

### 5.1 Develop captive breeding and release techniques.

Birds could be bred in captivity and released either in spring or fall. Timing of the release would depend on space limitations for holding the birds in captivity, importance of migrating during the first fall of life, development of site fidelity during the late summer, and other factors. Techniques should be developed with surrogate species to avoid placing Kirtland's warblers at risk.

### 5.2 Develop cross-fostering of Kirtland's warblers.

Clutches of eggs from nesting Kirtland's warblers could be substituted for the eggs of host species. Renesting of the warblers can be expected, thus avoiding risk to current low population levels. A determination that fledglings so produced will form a successful breeding population nucleus needs to be made. Techniques should be developed with surrogate species until successful fledging of Kirtland's warblers from a host species nest can be expected.

### 5.3 Develop captive wintering techniques.

Birds could be captured in autumn and held over winter in pairs and under light regimes similar to those they would encounter on their wintering grounds. They could then be released in spring at reintroduction sites. Heavy over-winter mortality would be avoided and pairs would be available for spring release in new sites. Techniques should be developed with surrogate species to avoid placing Kirtland's warblers at risk.

### 5.4 Select appropriate sites and implement emergency measures.

Appropriate sites will be selected, considering the factors leading to the emergency situations, and the type of release to be made. Following the release, detailed monitoring of the released birds will be carried out.

#### D. LITERATURE CITED

- Byelich, J. et. al. 1976. Kirtland's warbler recovery plan. FWS, Twin Cities, MN. 74 pp.
- Kelley, S. T. and M. E. DeCapita. 1982. Cowbird control and its effect on Kirtland's warbler reproductive success. Wilson Bull. 94(3):363-365.
- Lane, J. 1975. Kirtland's warbler in Mexico. American Birds. 29(1):144.
- Mayfield, H. F. 1953. A census of the Kirtland's warbler. Auk. 70:17-20.
- , 1960. The Kirtland's warbler. Cranbrook Inst. Sci., Bloomfield Hills, Michigan.
- , 1962. 1961 Decennial census of the Kirtland's warbler. Auk. 79:173-182.
- , 1963. Establishment of preserves for the Kirtland's warbler in the State and National Forests of Michigan. Wilson Bull. 75:216-220.
- , 1972a. Third Decennial census of Kirtland's warbler. Auk. 89:263-268.
- , 1972b. Winter habitat of Kirtland's warbler. Wilson Bull. 84(3):347-349.
- , 1973a. Census of Kirtland's warbler in 1972. Auk. 90:684-685.
- , 1973b. Kirtland's warbler census. American Birds. 27:950-952.
- , 1975. Numbers of Kirtland's warblers. Jack-Pine Warbler. 53:39-47.
- Orr, C. D. 1975. 1974 breeding success of the Kirtland's warbler. Jack-Pine Warbler. 53:59-66.
- Radabaugh, B. E. 1974. Kirtland's warbler and its Bahama wintering grounds. Wilson Bull. 96:374-383.
- Radtke, R. and John Byelich. 1963. Kirtland's warbler management. Wilson Bull. 75:208-215.
- Robertson, W. B. Jr. 1971. (Regional reports. The Fall migration, Aug. 16 to Nov. 30, 1970). Florida region. Am. Birds. 25(1):44-49.
- Ryel, L. A. 1976. 1975 Census of Kirtland's Warbler. Jack-Pine Warbler. 54:2-6.
- , 1984. Situation report, Kirtland's warbler, 1984. Mich DNR Wildlife Div. Report 2983. 10 pp.
- Schempf, P. F. 1976. A late record of the Kirtland's warbler. Jack-Pine Warbler 54:40.

Shake, W. F. and J. P. Mattsson. 1975. Three years of cowbird control: an effort to save the Kirtland's warbler. Jack-Pine Warbler. 53:48-53.

Walkinshaw, L. H. 1972. Kirtland's Warbler - endangered. American Birds. 26:3-9.

-----, 1983. Kirtland's warbler, The natural history of an endangered species. Cranbrook Inst. Sci., Bloomfield Hills, MI .

----- and W. R. Faust. 1974. Some aspects of Kirtland's warbler breeding biology. Jack-Pine Warbler. 52:64-75.

----- and W. R. Faust. 1975. 1974 Kirtland's warbler nesting success in northern Crawford County, Michigan. Jack-Pine Warbler. 53:54-58.

Zimmerman, D. A. 1956. Jack pine association in the Lower Peninsula of Michigan: Its structure and composition. PhD thesis, Univ. of Mich.

### PART III

#### SCHEDULE OF PRIORITIES, RESPONSIBILITIES, AND COSTS

The environmental requirements for the survival of the warbler are precise. They are so exact that without some manipulation of habitat there is a real possibility that the species could disappear. Much is known about the warbler's breeding habitat requirements, and a great deal can be done to improve the present cover conditions. The situation of this endangered species today leaves us no alternatives. We must apply those treatment techniques which we know will work while there are still enough warblers available to respond to the improved habitat.

From the schedule of priorities, responsibilities, and costs developed in the 1977 Recovery Plan, the following activities received early consideration. These activities were undertaken to improve conditions for the warblers. Many of these programs have been completed, or are ongoing.

1. Identify, improve, expand, and protect the active nesting habitat. (completed)
2. Develop detailed plans for expanding suitable nesting habitat. (completed)
3. Protect the Kirtland's warbler on the existing breeding ground from any disturbances during nesting season. (ongoing)
  - (a) Post the active breeding range against all trespass without permission.
  - (b) Maintain a high nest productivity of Kirtland's warblers by controlling cowbirds on the nesting grounds.
  - (c) Develop and maintain an Information and Education Program to keep the public informed on the plight of the Kirtland's warbler.
  - (d) Provide an opportunity for the public to see the species in its habitat through conducted field tours.

Priorities in column four of the following implementation schedule are assigned as follows:

1. Priority 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly.
2. Priority 2 - An action that must be taken to prevent a significant decline in species population/habitat quality, or some other significant negative impact short of extinction.
3. Priority 3 - All other actions necessary to provide for full recovery of the species.





GENERAL CATEGORIES FOR IMPLEMENTATION SCHEDULE (COLUMN 1)

Information Gathering - I or R (research)

1. Population status
2. Habitat status
3. Habitat requirements
4. Management techniques
5. Taxonomic studies
6. Demographic studies
7. Propagation
8. Migration
9. Predation
10. Competition
11. Disease
12. Environmental contaminant
13. Reintroduction
14. Other information

Management - M

1. Propagation
2. Reintroduction
3. Habitat maintenance and manipulation
4. Predator and competitor control
5. Depredation control
6. Disease control
7. Other management

Acquisition - A

1. Lease
2. Easement
3. Management agreement
4. Exchange
5. Withdrawal
6. Fee title
7. Other

Other - O

1. Information and education
2. Law enforcement
3. Regulations
4. Administration

Abbreviations used in Columns 4 through 12

DMA	Michigan Department of Military Affairs
DNR	Michigan Department of Natural Resources
FS	U. S. Forest Service
HR	Habitat Resources Program
MNDNR	Minnesota Department of Natural Resources
OES	Office of Endangered Species (Washington office)
OMNR	Ontario Ministry of Natural Resources
SE	Endangered Species Division (Regional office)
TBD	To Be Determined
WA	Wildlife Assistance Division
WIDNR	Wisconsin Department of Natural Resources
RE	Wildlife Resources, Realty Division

# RECOVERY PLAN IMPLEMENTATION SCHEDULE

## KIRTLAND'S WARBLER

GEN. CAT.	PLAN TASK	TASK #	PRIOR-ITY #	TASK DURATION	RESPONSIBLE AGENCY			FISCAL YEAR COSTS (EST.) (\$1,000's)			COMMENTS/NOTES
					FWS	OTHER		FY 86	FY 87	FY 88	
						REG.	PROGRAM				
M3	Fire control	1.111	1	Ongoing	3	SE	DNR, FS	TBD	TBD	TBD	Costs for 1.11 subtasks are unpredictable and will depend upon the annual need for such work.
M6	Insect/disease control	1.112	1	Ongoing	3	SE	DNR, FS	TBD	TBD	TBD	"
M3	Improve habitat	1.12	1	Ongoing	3	SE	DNR, FS	50	50	50	
M3	Establish new habitat	1.13	1	Ongoing	3	SE	DNR, FS	275	295	295	Cost increases as new acquisitions undergo initial management.
04	Revise and update management plan	1.14	2	3 years	3	SE	DNR	5	5	5	Revise existing plan in FY 86. Develop plan for FWS lands in FY 87-88.
M3	Technical assistance to private landowners	1.2	3	Ongoing	3	SE	FS, DNR	1	1	1	
04	Manage habitat at Camp Grayling - prepare and implement plan	1.3	2	1985-6	3	SE	DNR, DMA	-	15	15	Plan to be completed in FY 85 and 86. Implementation to begin in 87.

35

RECOVERY PLAN IMPLEMENTATION SCHEDULE  
KIRTLAND'S WARBLER

GEN. CAT.	PLAN TASK	TASK #	PRIOR- ITY #	TASK DURATION	RESPONSIBLE AGENCY			FISCAL YEAR COSTS (EST.) (\$1,000's)			COMMENTS/NOTES
					FWS	OTHER		FY 86	FY 87	FY 88	
						REG.	PROGRAM				
A6	Acquire key tracts	1.4	1	Through 1988	3	SE, RE	FS, DNR		1,100	500	
O1	Information and education	1.5	3	Ongoing	3	SE	DNR	5	5	5	
R	Meet research needs Individual research items are listed and tentative- ly prioritized in Appendix A. See comment at right.	1.6	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	Priority and costs of remaining research needs TBD after adverse winter- ing and migration factors are assessed and reduced (2.1 and 2.2)
M3	Identify stocked areas and areas needing planting and sanitation	1.71	1	Ongoing	3	SE	FS, DNR	5	5	5	
R4	Improve cultural treatments for habitat development	1.72	3		3	SE	FS, DNR			5	Begin in FY 88. Follow-up evaluation needed in sub- sequent years.
R1	Locate and monitor winter- ing populations	2.11	1	Ongoing	3,8	SE	TBD			15	System to be developed and implemented after winter- ing study concluded.
R3	Delineate wintering habitat	2.12	1	FY 85 to 88	8	Research		330	330	330	Work begun in FY 85
M7	Establish cooperative programs to protect essential wintering habitat	2.122	1	FY 88 to 90	9	OES	TBD			15	Cost share with other governments and conserva- tion organizations.
36											

RECOVERY PLAN IMPLEMENTATION SCHEDULE  
KIRTLAND'S WARBLER

GEN. CAT.	PLAN TASK	TASK #	PRIORITY #	TASK DURATION	RESPONSIBLE AGENCY			FISCAL YEAR COSTS (EST.) (\$1,000's)			COMMENTS/NOTES
					FWS	PROGRAM	OTHER	FY 86	FY 87	FY 88	
R2	Monitor land use changes on wintering grounds	2.123	2	Ongoing	3,8	SE	TBD			12	After base maps prepared, \$3,000 annually for monitoring beginning in FY 89
R14	Determine winter mortality factors	2.124	1	4 years	8	Research		Included in 2.122, above			
M7	Implement measures to reduce mortality	2.125	1	TBD	3,8,9	SE, OES	TBD			TBD	
R8	Determine migration route	2.21	TBD	TBD	3,4,8	SE, Research	States				Need for 2.2 tasks will be evaluated following completion of wintering ground study
M3	Protect essential sites	2.22	TBD	TBD	3	SE	TBD				"
M7	Eliminate or reduce adverse factors during migration	2.23	TBD	TBD	3	SE	TBD				"

RECOVERY PLAN IMPLEMENTATION SCHEDULE  
KIRTLAND'S WARBLER

GEN. CAT.	PLAN TASK	TASK #	PRIOR-ITY #	TASK DURATION	RESPONSIBLE AGENCY		FISCAL YEAR COSTS (EST.) (\$1,000's)			COMMENTS/NOTES	
					FWS	OTHER	FY 86	FY 87	FY 88		
											REG.
01	Provide I&E program	3.11	3	Ongoing	3	SE, WA	FS, DNR	20	20	20	
02,03	Protect occupied nesting area	3.121	1	Ongoing	3	SE	FS, DNR	5	5	5	
A3,02	Cooperative agreements to close private lands	3.122	3	Ongoing	3	SE	FS, DNR	1	1	1	
A3	Regulate Nat'l Guard activities via review and revision of coop agreement	3.123	1	Ongoing	3	SE	DNR	1		1	Biennial
02,03	Eliminate take	3.13	2	Ongoing	3	SE	FS, DNR	2	2	2	
M4,M6	Maintain cowbird control	3.21	1	Ongoing	3	SE,WA	FS, DNR	40	40	40	
R4,R9,R10	Identify and control parasites, predators, etc.	3.22	3	TBD	3,8	SE, Research	DNR				Estimate that 50K will be needed for this research. Costs for control TBD
R4	Monitor and evaluate control programs	3.3	1	Ongoing	3	SE,WA	DNR	2	2	2	Costs shown are for cowbird control program only. Costs for other control programs resulting from 3.22 will be determined at a later date.

38

RECOVERY PLAN IMPLEMENTATION SCHEDULE  
KIRTLAND'S WARBLER

GEN. CAT.	PLAN TASK	TASK #	PRIOR-ITY #	TASK DURATION	RESPONSIBLE AGENCY			FISCAL YEAR COSTS (EST.) (\$1,000's)			COMMENTS/NOTES
					FWS	OTHER		FY 86	FY 87	FY 88	
						REG.	PROGRAM				
R1	Survey singing males on nesting range	4.1	1	Ongoing	3	SE, WA	FS, DNR	7	7	7	
R1	Survey in similar habitats	4.2	3	Ongoing	3	SE	FS, DNR, MNDNR, WIDNR, OMNR	5	5	5	
R1	Evaluate data, prepare reports	4.3	1	Ongoing	3	SE	DNR	1	1	1	
R13	Develop captive breeding and release techniques	5.1	1	3 years	8	Ohio coop unit			63	60	\$67k in FY 89
R13	Develop cross-fostering techniques	5.2	3*	TBD	8	TBD	TBD				
R13	Develop captive wintering techniques	5.3	1	3 years	8	Ohio coop unit	Costs included with those for 5.1				
R13	Identify suitable release sites and implement emergency measures	5.4	1	TBD	TBD	TBD	TBD				Work will begin following completion of 5.1, 5.2, or 5.3. Costs TBD.
M2	Implement emergency measures	5.5	1	TBD	TBD	TBD	TBD				
*Priority number will be revised if planned research under 5.1 and 5.3 is unsuccessful.											

39





## Appendices

A. Research Needs	41
B. Habitat Management Plan (Summary)	49
C. Essential Habitat	50
D. Desirable Habitat for Acquisition	75



## APPENDIX A

### KIRTLAND'S WARBLER RESEARCH NEEDS

PRIORITY\*

#### I. Life history

##### A. Breeding grounds

##### 1. Predation and disturbance

##### a. Nest - eggs and nestlings

##### (1) Cowbird - - - - - L

(a) Control levels needed for  
Kirtland's warbler population  
recovery

(b) Optimum trap densities

(c) Optimum trapping period

(d) Other control methods

##### (2) Human - - - - - L

(a) Effect of recorded calls

(b) Effect of disturbance by  
birders and photographers

(c) Effect of disturbance by  
off-road vehicles and military  
operations

(d) Effect of housing developments

##### (3) Relative importance of other species - - - - M

(bluejays, grackles, ground squirrels,  
red squirrels, snakes, ants, etc.)

##### (a) Control measures - - - - - L

(1) Trapping and moving or killing

(2) Effect of fire

(3) Shooting

##### b. Fledglings and adults - - - - - M

(1) Species involved (hawks, house cats,  
weasels, others)

(2) Importance

(3) Control measures

##### 2. Habitat preferences - - - - - H

##### a. Nesting

(1) Structure of overstory on occupied sites

(2) Overstory species and diversity on  
occupied sites

(3) Structure of ground cover on occupied  
sites

(4) Ground cover species and diversity on  
occupied sites

(5) Slope

\* These priorities are tentative, and will be reviewed by the Research Committee.

PRIORITY

- (6) Size and configuration of habitat type
- (7) Soil type
- (8) Comparisons with similar unoccupied habitat
- (9) Determining historical changes in "suitable" habitat
- (10) Determining amount of "suitable" habitat needed for population goals
- b. Fledglings - - - - - H
  - (1) Structure of overstory on sites used
  - (2) Overstory species and diversity on sites used
  - (3) Structure of ground cover on sites used
  - (4) Ground cover species and diversity on sites used
  - (5) Comparison with non-used habitats in vicinity
- 3. Weather - - - - - L
  - a. Effects on fledglings produced
  - b. Effects on fledgling survival
- 4. Food supplies - - - - - H
  - a. Kinds of insects consumed in relation to time
  - b. Effect of pesticides on food
  - c. Number of insects per unit area in various habitats occupied and unoccupied
- 5. Diseases and parasites - - - - - L
- 6. Range expansion - - - - - M
  - a. Imprinting on breeding sites
    - (1) When territories selected
    - (2) How habitat located
  - b. Cross-fostering
    - (1) Development of techniques on related species of warblers raised by various foster parents
      - (a) Transfer of eggs
      - (b) Transfer of nestlings
    - (2) Trials with Kirtland's warblers
  - c. Inventory of potential breeding habitat outside traditional range
    - (1) Michigan
    - (2) Other states and Canadian provinces
- 7. Census methodology and related - - - - - M-H
  - a. Frequency of singing
    - (1) By date and time of day
    - (2) In relation to nesting progress
    - (3) With various weather conditions
    - (4) In relation to matedness
  - b. Determination of matedness
    - (1) Males without mates
    - (2) Females without mates
    - (3) Males with two females
  - c. Identification of individual singing males

- (1) Plumage
  - (2) Sonagrams
- d. Use of sensitive microphones to aid in detection of song
- e. Determining distances songs can be heard under various weather conditions, land forms, and vegetation
- 8. Nesting and nest success - - - - - L-M
  - a. How territories are selected
    - (1) Males
    - (2) Females
    - (3) Differences by age
  - b. Differences in production by yearling and adult females
  - c. Extent of double-broodedness
  - d. Success of first nestings and second nestings
  - e. Survival of first broods and second broods
- B. Plumages - - - - - M
  - 1. Identification of sex in fledglings
  - 2. Identification of yearling plumages in both sexes
- C. Migration - - - - - L-M
  - 1. Spring and fall
    - a. Timing of migration by sex and age classes
    - b. Migration routes
    - c. Whether birds fly non-stop or in steps
    - d. Whether birds fly in groups or singly
    - e. Effects of storm fronts and other weather patterns on movements
    - f. Mortality factors
      - (1) Lighted structures
      - (2) Storms
      - (3) Predation
      - (4) Pesticides
    - g. Habitat used during migration
  - 2. Spring - possible staging areas in Bahamas
- D. Wintering grounds - - - - - H
  - 1. Determination of wintering areas
    - a. Using tape recorded calls in Bahamas
    - b. Following radio-equipped birds from Florida
    - c. Other methods
  - 2. Habitats occupied
    - a. Location and extent of such habitat
    - b. Disturbance by human activities
    - c. Habitat changes, natural and man-caused
    - d. Management possibilities
    - e. Need for refuges
  - 3. Food supplies
    - a. Insects
    - b. Other foods
  - 4. Mortality factors
    - a. Predation
    - b. Food shortages

PRIORITY

- (1) Drought
    - (2) Competition with other birds
      - (a) Other Kirtland's warblers
      - (b) Other species
    - c. Storms, hurricanes and thunderstorms
  - 5. Sociability
    - a. Do birds winter alone or in groups
    - b. Other associates
    - c. Are they territorial?
- E. Population modeling - - - - - M
  - 1. Development of a predictive model using a variety of population, habitat, and weather parameters
  - 2. Determining optimum management strategies using model
  - 3. Obtaining weather data directly from Bahamas

II. Habitat regeneration on breeding grounds - - - - - H

- A. Creating preferred jack pine habitat
  - 1. Regeneration by fire
    - a. Compare success of stands which have been regenerated with and without fire
      - (1) Overstory
      - (2) Ground vegetation
    - b. Investigate how to achieve proper fire characteristics for optimum seed production with prescribed burns
      - (1) Surface versus crown fires
      - (2) Season of burn
      - (3) Intensity
      - (4) Ground moisture conditions
    - c. Determine optimum number and placement of seed trees
    - d. Determine role of slash in seed production following regular cutting cycle
  - 2. Planting
    - a. Site preparation needed
      - (1) Cutting methods, clearcut vs. shelterwood for shade and wind control
      - (2) Need for fire for ground preparation
      - (3) Value of roller chopper for ground preparation
      - (4) Other scarification and weed control techniques
      - (5) Slash disposal methods
    - b. Evaluate various sizes and configurations of blocks
      - (1) Optimum spacing of blocks from each other
      - (2) Optimum block size
      - (3) Optimum configuration of plantings
        - (a) Standing wave
        - (b) Other
        - (c) Tree density - spacing

PRIORITY

- c. Type of planting material used
  - (1) Compare various genetic stocks
  - (2) Compare success of seeds versus seedlings
  - (3) Evaluate age of seedlings on costs and survival
  - (4) Develop optimum cultural methods for seedlings
  - (5) Determine value of using seedling - - - - - M containers
  - (6) Conduct trials of pelleted seeds - - - - - M
- d. Developing efficient planting methods - - - - - L
  - (1) Determine optimum tree spacings for regular block plantings
  - (2) Study of interplanting and spot replacement techniques
  - (3) Develop efficient machine and hand planting equipment
  - (4) Develop optimum packing, shipping, and handling procedures for seedlings
  - (5) Evaluate direct seeding methodology
  - (6) Compare costs of various methods
- 3. Management of habitat created by wild fires - - - - - M
  - a. Determine need for spot seeding
  - b. Determine need for interplanting
  - c. Determine positive and negative effects of dead tree removal
    - (1) Firewood sales
    - (2) Commercial removal of standing trees
  - d. Determine need for coppice control on deciduous trees
  - e. Determine need for development of natural firebreaks
- 4. Develop information system to store detailed - - - - - H records on successfully and unsuccessfully regenerated stands, both natural and artificial
  - a. Historical
    - (1) Obtain and examine available information on older regenerated stands
    - (2) Measure relative success of these efforts
  - b. Recent
    - (1) Record all pertinent data prior to and during regeneration process
    - (2) Carry out periodic examinations of stands
  - c. Conduct analyses of data
- 5. Develop management guidelines which consider - - - - - L-M various combinations of:
  - a. Site indices
  - b. Water table levels
  - c. Slopes
  - d. Other tree and shrub species
  - e. Soils
  - f. Markets

PRIORITY

- B. Protection of habitat - - - - - L
  - 1. Insects and disease
    - a. Determine species involved and probable effects
      - (1) Anomala beetle
      - (2) White pine weevil
      - (3) Sawflies
      - (4) Budworms
      - (5) Grubs
      - (6) Others
    - b. Develop control methods
      - (1) Role of fire prior to regeneration
      - (2) Pesticides
      - (3) Natural predators - thatch ant, others
      - (4) Other
  - 2. Wildfires - - - - - L
    - a. Develop better methods of stopping wildfires
    - b. Develop ways of monitoring weather changes prior to and during prescribed burns
    - c. Develop natural firebreaks in management areas
- C. Marketing jack pine - - - - - M
  - 1. Find markets for burned standing trees
  - 2. Develop steady markets for 50-year-old trees
  - 3. Investigate markets for "young" trees
  - 4. Prepare benefit-cost ratios of various management strategies
- D. Study of alternate tree species - - - - - L
  - 1. Try other conifer species to see if they will grow successfully on Grayling sand
    - a. Lodgepole pine
    - b. Scotch pine
    - c. Other species
  - 2. Prepare experimental plantations of proper size and configuration
    - a. Study growth and economic considerations
    - b. Observe use by Kirtland's warblers



PRIORITY

III. Jack pine ecosystem - - - - - M-H

- A. Prepare detailed inventories of all plant and animal species present in jack pine stands in relation to the age, density, and composition
  - 1. Measure animal species changes over time
  - 2. Measure plant species changes over time
- B. Monitor the effects of Kirtland's warbler management on the abundance of other species
  - 1. Animals
  - 2. Plants

Note: A proposal for research of the jack pine ecosystem related to Kirtland's warbler habitat and population dynamics is being prepared and will include several of the above listed categories.





# MANAGEMENT PLAN for KIRTLAND'S WARBLER Habitat

## Appendix B

FOREST SERVICE



U.S. DEPARTMENT OF AGRICULTURE

MICHIGAN DEPARTMENT



OF NATURAL RESOURCES

## APPENDIX B

### SUMMARY - HABITAT MANAGEMENT PLAN

A Habitat Management Plan, approved in 1981 by the Forest Service and Michigan Department of Natural Resources, provides direction for implementing the habitat management objective established in the Recovery Plan. There are on 53,488 acres of the Huron-Manistee National Forest and 74,143 acres of State lands within the AuSable, Mackinac, and Pere Marquette State Forests that have been designated as essential habitat and are being managed to provide a sustained, even flow of suitable nesting habitat. The Habitat Management Plan coordinates timber resource values with nesting requirements of the Kirtland's warbler. The basic provisions of the Habitat Management Plan are outlined below:

#### I. MANAGEMENT DIRECTIONS

##### A. Habitat Management Framework

This section provides direction for establishing management area and units, rotation age, and cutting schedules.

##### B. Silviculture

Defines the management systems that will produce suitable Kirtland's warbler nesting habitat. Provides the direction for final harvest methods, site preparation, regeneration, cultural and intermediate treatments.

##### C. Species and Habitat Protection

Provides direction for fire prevention and control, insect and disease control, predator and parasite control; and coordinates other activities including recreational use, road construction, mineral development and other activities to protect the warblers and their habitats.

The "Management Plan for Kirtland's warbler Habitat in Michigan" contains detailed direction for habitat management on 23 Management Areas on State and National Forest lands. Harvest cutting blocks are identified, and detailed silvicultural guidelines established to achieve the nesting habitat objectives of the Recovery Plan. This 837 page document is available for review by contacting the Forest Supervisor, Huron-Manistee National Forest, or Director, Michigan Department of Natural Resources.

APPENDIX C  
DESCRIPTION AND MAPS OF  
ESSENTIAL HABITAT  
for the  
KIRTLAND'S WARBLER

DESCRIPTION OF ESSENTIAL HABITAT

The Kirtland's warbler does not adapt to a variety of environmental conditions. Its requirements for breeding habitat are quite specific, so exact that its numbers will probably always be limited. The essence of its habitat is the jack pine forest. For this reason, it is often called the jack pine warbler. However, its habitat is more than just jack pine. The bird requires certain exacting conditions for nesting. Almost without exception, it is found only in extensive, homogenous stands of young jack pine located on some of the poorest soils in Michigan.

The plant community attractive to this warbler developed in the past from repeated and extensive forest fires. Historically, wildfires have been the most important factor in the establishment of natural jack pine. These fires played an important role in past survival of the warbler since, under natural conditions, suitable habitat was produced only by forest fires. With the advent of fire protection there was a drastic decline of such suitable habitat. Nesting habitat generally consists of young jack pine stands between 5 and 20 feet in height. Dense stands with the pines in close juxtaposition yet interspersed with small openings are best, the pattern which often results from forest fires. Such cover is not attractive to many other species of wildlife, resulting in less competition than might otherwise be expected. A breeding pair of warblers requires about 30 acres of this type for their nesting territory.

The low-growing, sparse vegetation that occurs in association with the young "Christmas tree"-size jack pine on the relatively level sandy outwash plains is an important component of the habitat necessary for the warblers. The delicate combination of conditions required exists for a relatively short period of time, lasting only 10-15 years before it is no longer acceptable.

Habitat for the Kirtland's warbler is considered essential where its destruction, disturbance, modification, or subjection to human activity might be expected to result in a further reduction in numbers of this species, or in a reduction in its potential for expansion or recovery. Essential habitat is defined to mean areas that are presently occupied by nesting pairs, and areas that can be expected to be utilized at some future time. The designation of such potential nesting areas is necessary because the birds' occupancy of any tract is temporary, extending through only one early stage of the jack pine growth cycle.

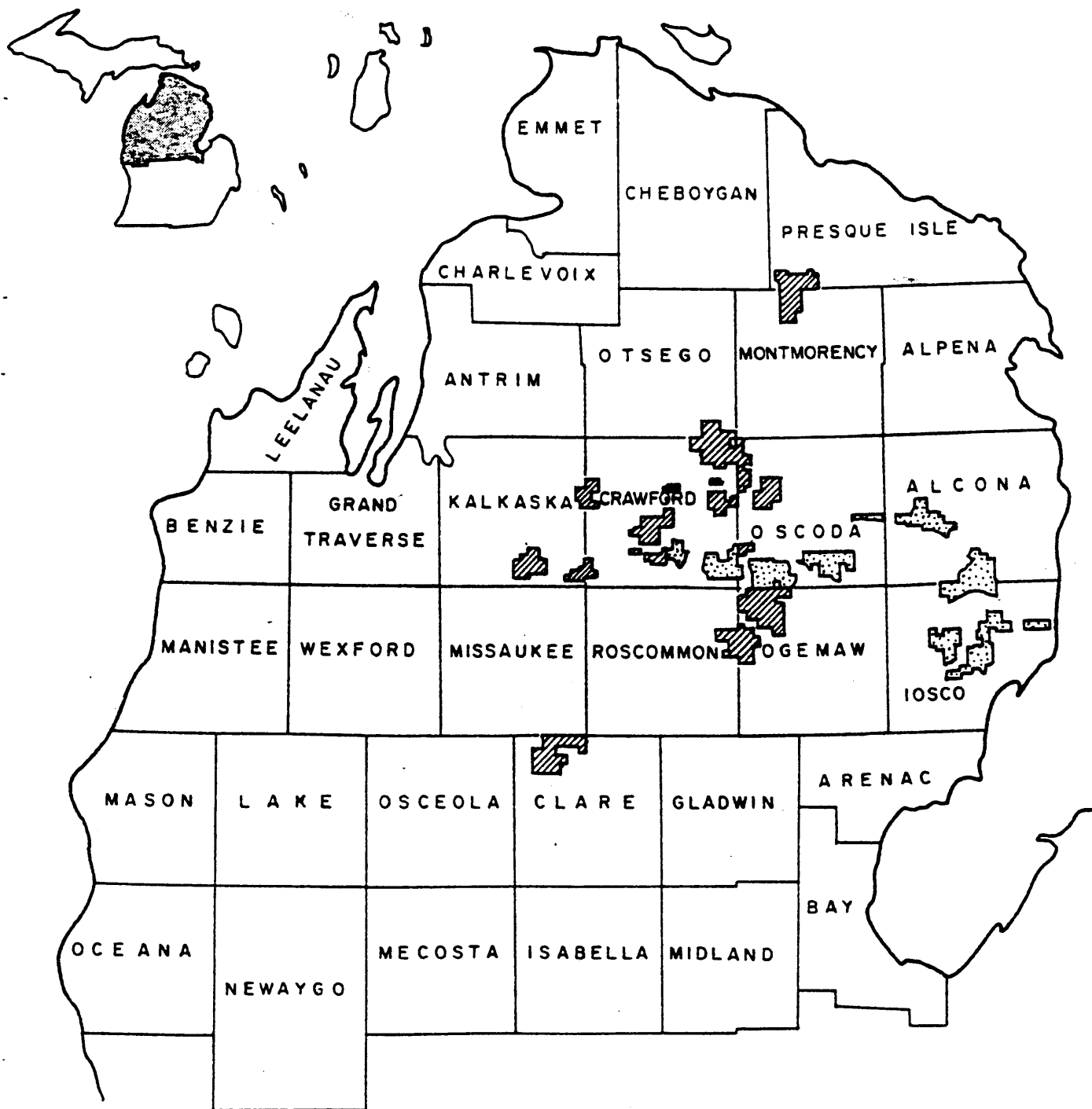
Potential habitat consists of those stands of jack pine that, through management, will provide acceptable habitat at some future date. Such stands can be managed for eventual harvest of the timber resource, with economical harvest at 45 - 50 years of age. Since the warbler occupies a tract for only about 12 years within this age span, to achieve a stable population of 1,000 pairs will require 38,000 acres of nesting habitat at all times. To meet an objective of a sustained supply of nesting habitat sufficient to support 1,000 pairs will require the designation of some 127,500 acres as essential habitat.




The criteria used for designation of essential habitat include:

1. Soil type - Grayling sand and closely associated soil types.
2. Forest cover currently in jack pine and where management for jack pine is feasible. Areas may contain a limited oak component. Habitat with significant levels of non-characteristic vegetative types (aspen, willow, cherry, etc.) was excluded.
3. Areas currently occupied or previously used by the species.
4. Tracts of about 320 acres or larger, preferably where five or more of them lie within two miles of each other. Tracts less than 320 acres, but not less than 80 acres, where they occur in close proximity to the larger tracts.
5. Lands preferably in public ownership (State or National Forests).
6. Limited development potential or where development could be controlled.
7. Relatively level topography.

#### Essential Habitat

The attached maps show the approximate location of the essential habitat. Detailed maps are available and on file with the Secretary of Interior; Director, Michigan Department of Natural Resources; and Forest Supervisor, Huron-Manistee National Forest.



-  U.S. Forest Service Essential Habitat
-  State Forest Essential Habitat
-  Military Area Habitat

# KIRTLAND'S WARBLER HABITAT IN MICHIGAN

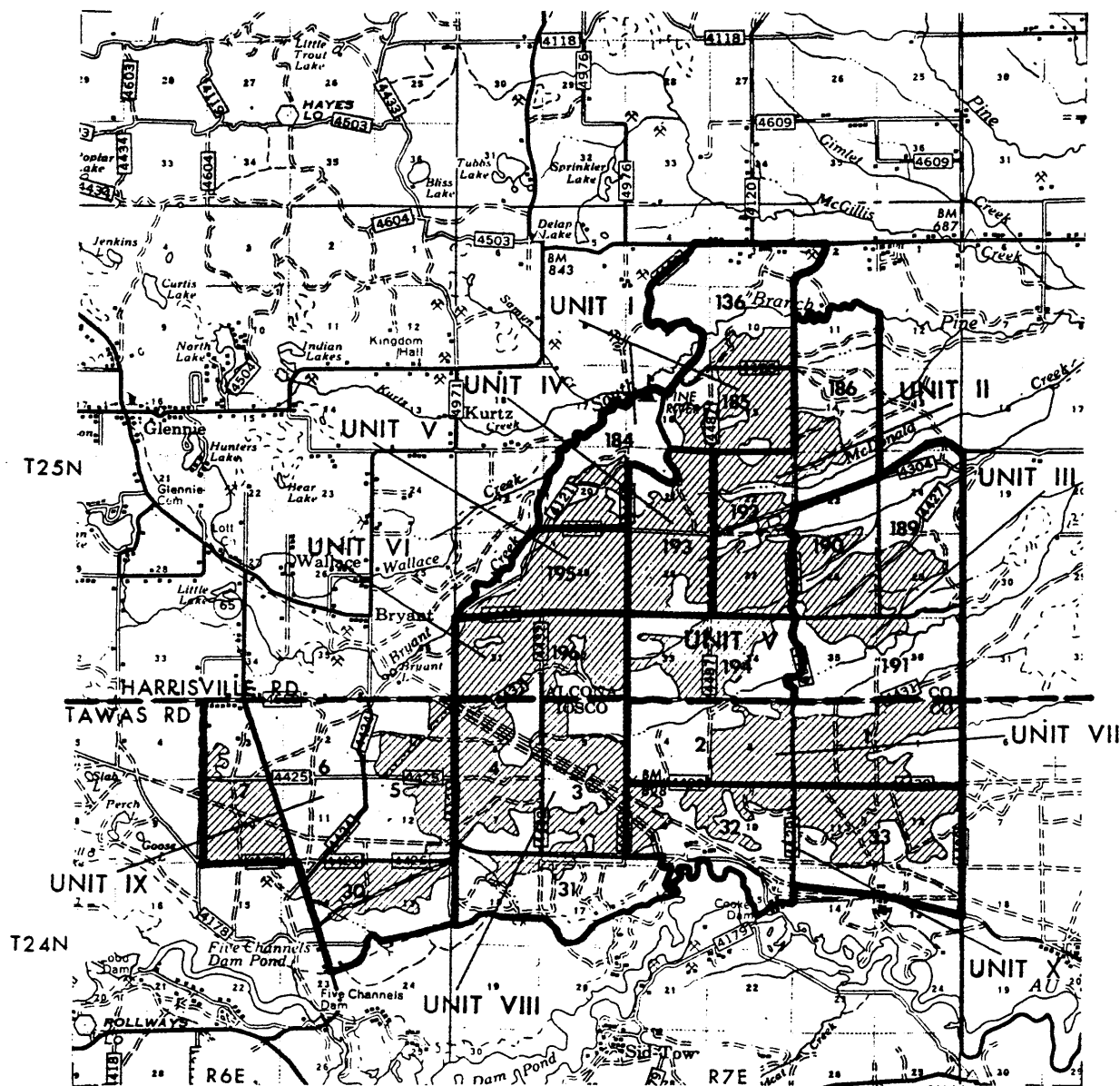
# HURON-MANISTEE NATIONAL FOREST

## KIRTLAND'S WARBLER MANAGEMENT AREA

### PINE RIVER

ALCONA & IOSCO COUNTIES, MICH.

1978



#### LEGEND

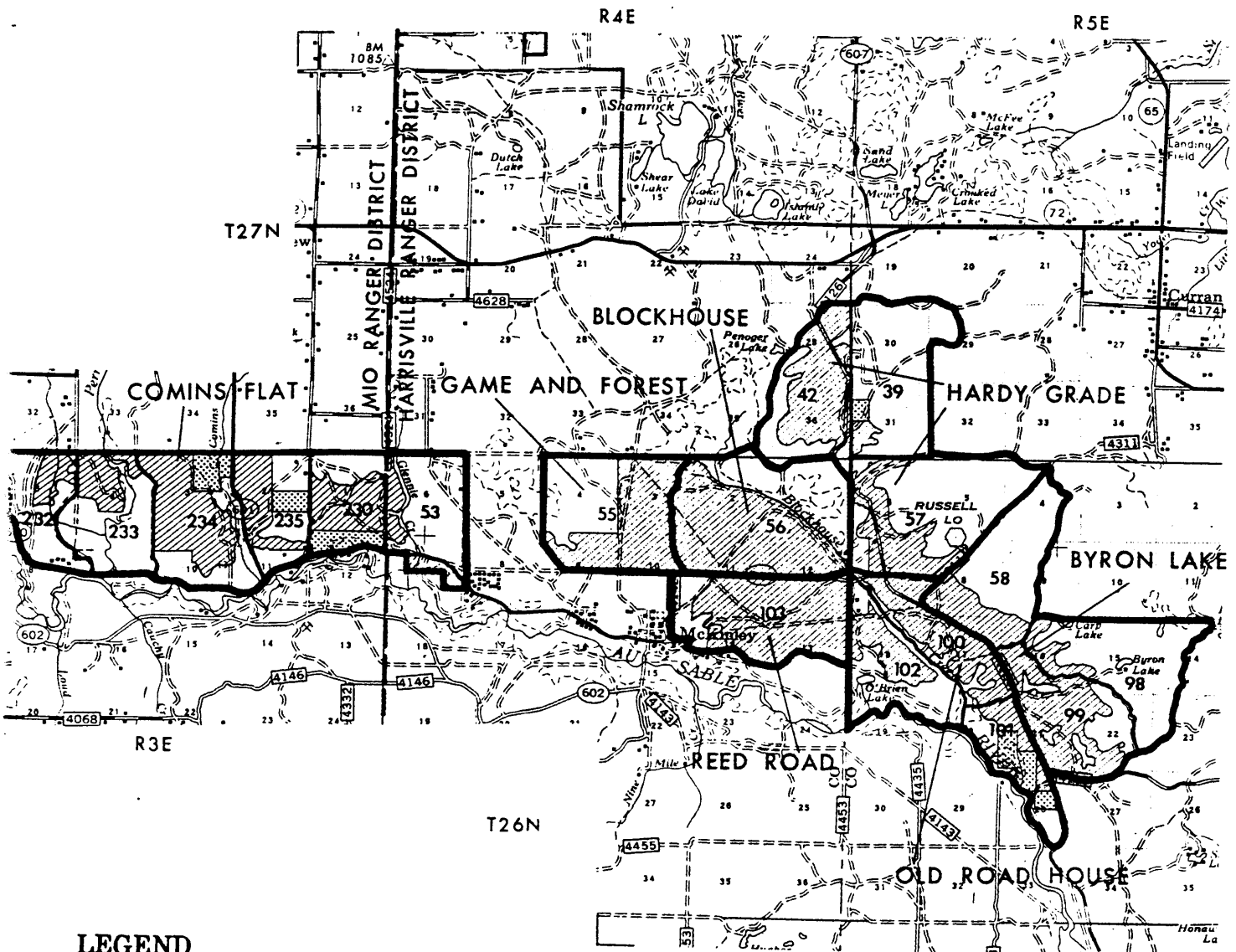
- UNIT BOUNDARY**
- COMPARTMENT BOUNDARY**
- RANGER DISTRICT BOUNDARY**
- ESSENTIAL HABITAT IN NATIONAL FOREST OWNERSHIP**
- POTENTIAL HABITAT IN PRIVATE OWNERSHIP**

SCALE 1/2" = 1 MILE



**HURON-MANISTEE NATIONAL FOREST**  
**KIRTLAND'S WARBLER MANAGEMENT AREA**  
**McKINLEY**  
 OSCODA & ALCONA COUNTIES, MICH.

1978



**LEGEND**

- UNIT BOUNDARY
- COMPARTMENT BOUNDARY
- RANGER DISTRICT BOUNDARY
- ESSENTIAL HABITAT IN NATIONAL FOREST OWNERSHIP
- POTENTIAL HABITAT IN PRIVATE OWNERSHIP

SCALE 1/2" = 1 MILE

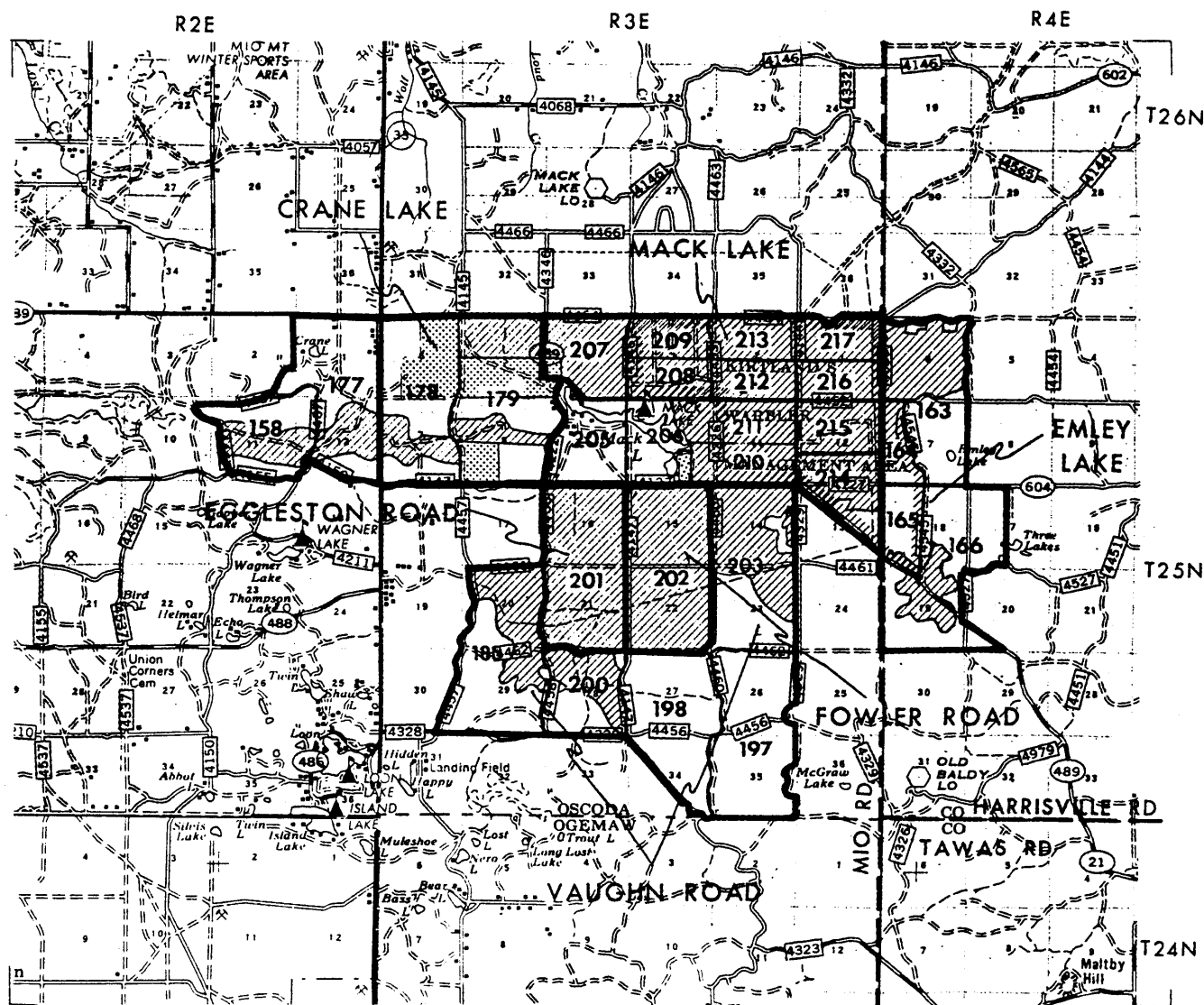
# HURON-MANISTEE NATIONAL FOREST

## KIRTLAND'S WARBLER MANAGEMENT AREA

### MACK LAKE

#### OSCODA COUNTY, MICH.

MARCH, 1978



#### LEGEND

- UNIT BOUNDARY
- COMPARTMENT BOUNDARY
- RANGER DISTRICT BOUNDARY
- ESSENTIAL HABITAT IN NATIONAL FOREST OWNERSHIP
- ▨ POTENTIAL HABITAT IN PRIVATE OWNERSHIP

SCALE 1/2" = 1 MILE

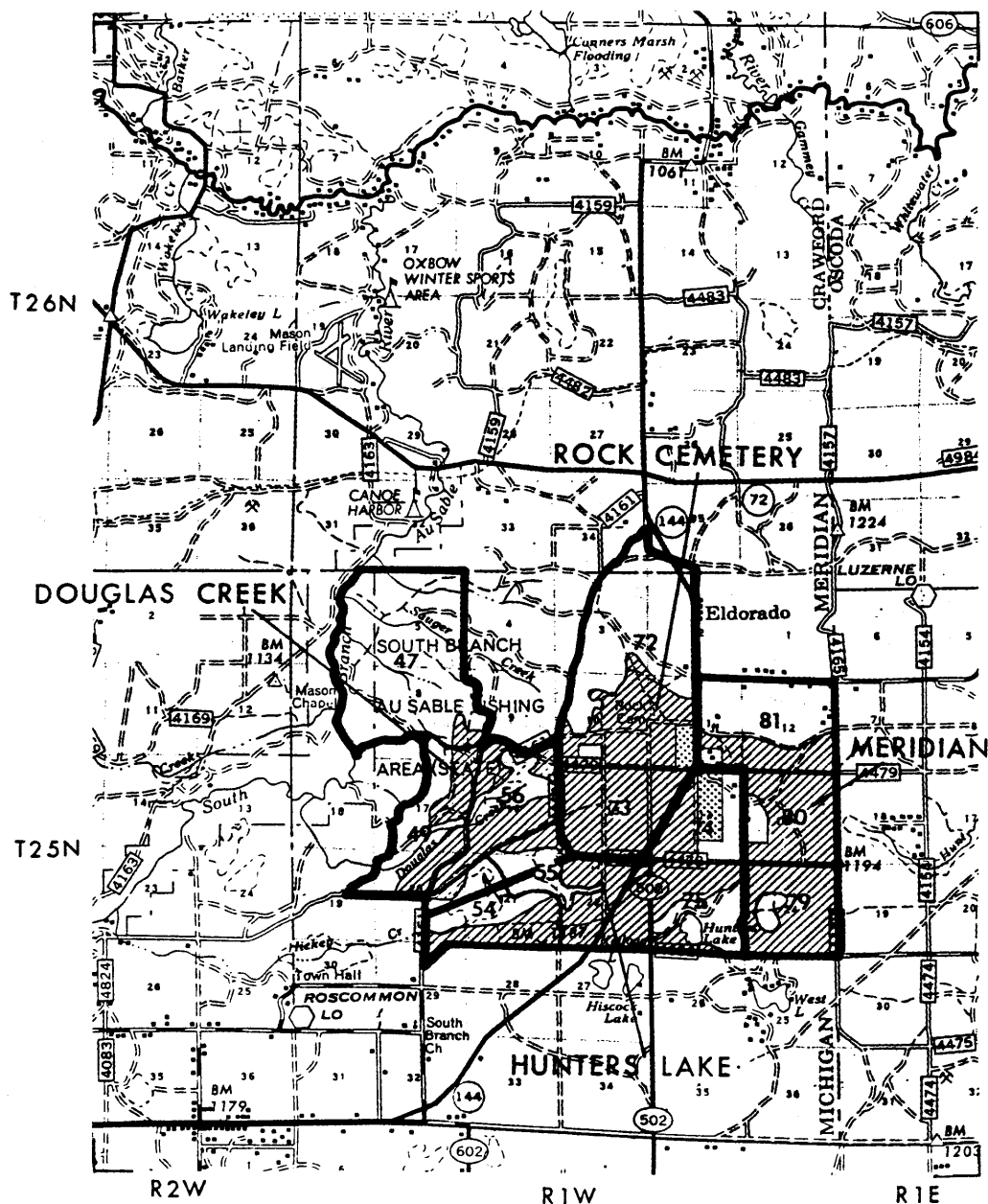
# HURON-MANISTEE NATIONAL FOREST

## KIRTLAND'S WARBLER MANAGEMENT AREA

### ELDORADO

#### CRAWFORD COUNTY, MICH.

1978



#### LEGEND

- UNIT BOUNDARY
- COMPARTMENT BOUNDARY
- - - RANGER DISTRICT BOUNDARY
- ▨ ESSENTIAL HABITAT IN NATIONAL FOREST OWNERSHIP
- ▤ POTENTIAL HABITAT IN PRIVATE OWNERSHIP

SCALE 1/2" = 1 MILE

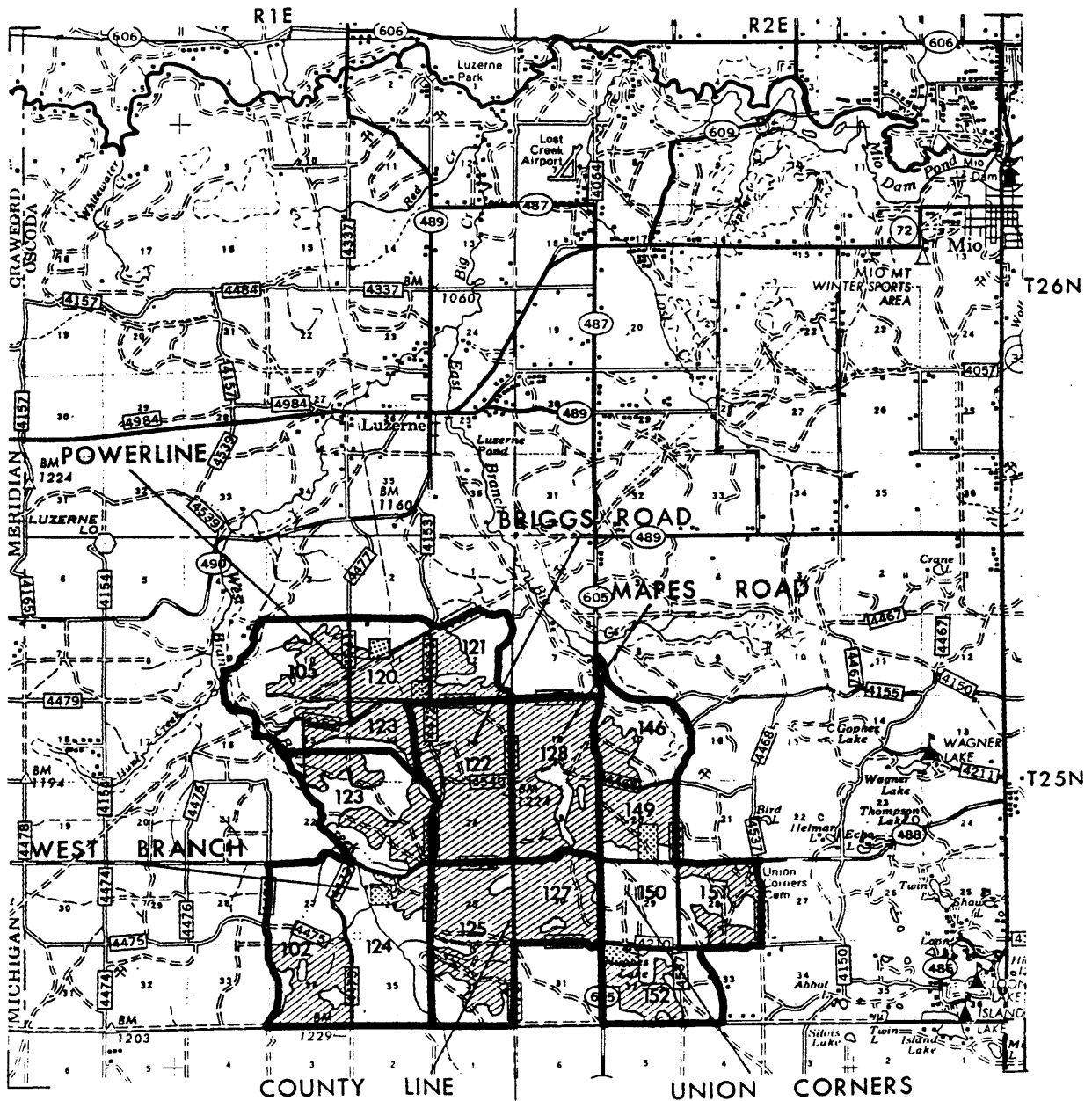
# HURON-MANISTEE NATIONAL FOREST

## KIRTLAND'S WARBLER MANAGEMENT AREA

### BIG CREEK

OSCODA COUNTY, MICHIGAN

1978

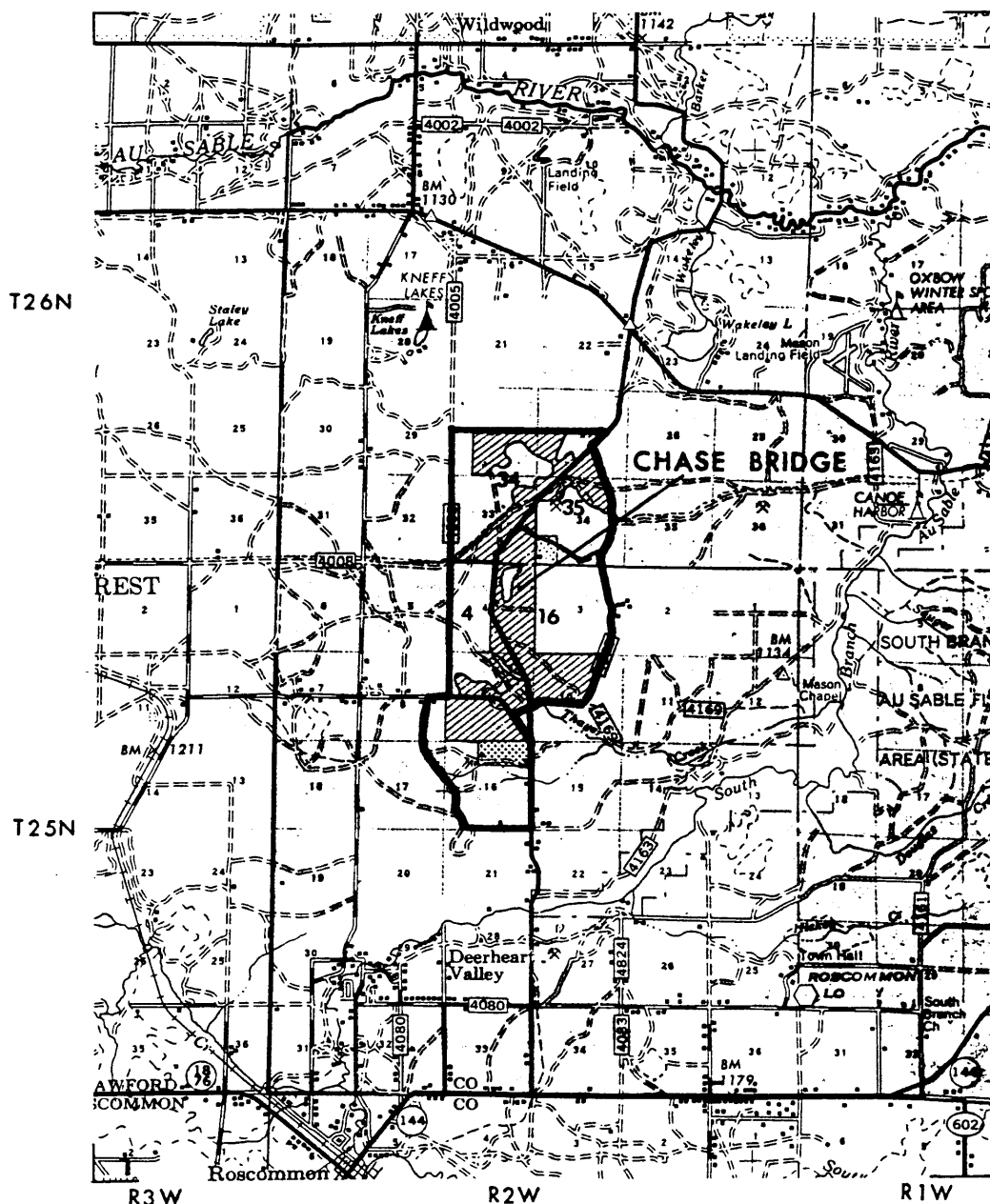


#### LEGEND

- UNIT BOUNDARY
- COMPARTMENT BOUNDARY
- RANGER DISTRICT BOUNDARY
- ESSENTIAL HABITAT IN NATIONAL FOREST OWNERSHIP
- POTENTIAL HABITAT IN PRIVATE OWNERSHIP

SCALE 1/2" = 1 MILE

# HURON-MANISTEE NATIONAL FOREST KIRTLAND'S WARBLER MANAGEMENT AREA PERE CHENEY CRAWFORD COUNTY, MICH. 1978



## LEGEND

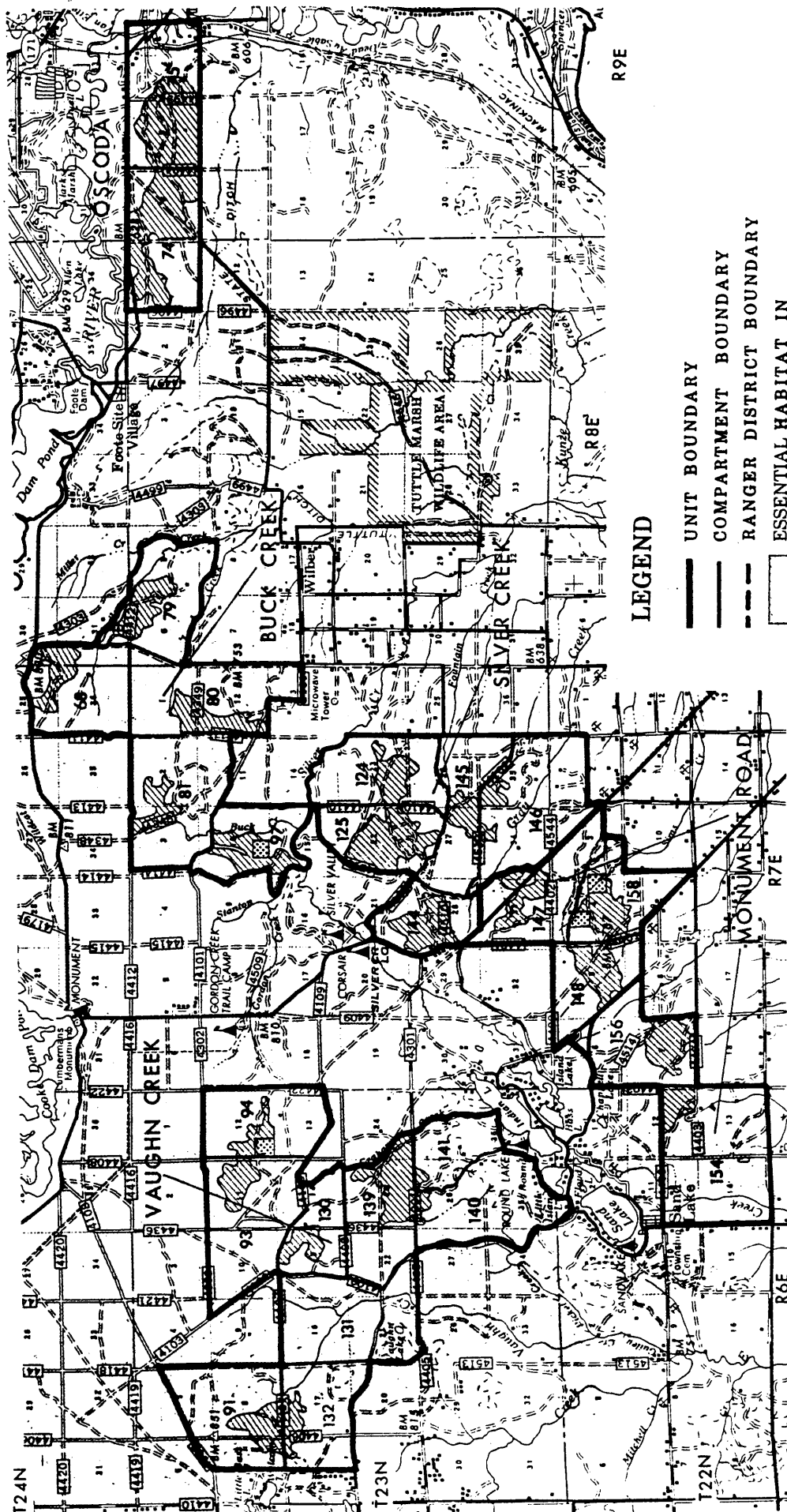
- UNIT BOUNDARY
- COMPARTMENT BOUNDARY
- - - RANGER DISTRICT BOUNDARY
- ▨ ESSENTIAL HABITAT IN NATIONAL FOREST OWNERSHIP
- ▤ POTENTIAL HABITAT IN PRIVATE OWNERSHIP

SCALE 1/2" = 1 MILE

# HURON-MANISTEE NATIONAL FOREST KIRTLAND'S WARBLER MANAGEMENT AREA TAWAS

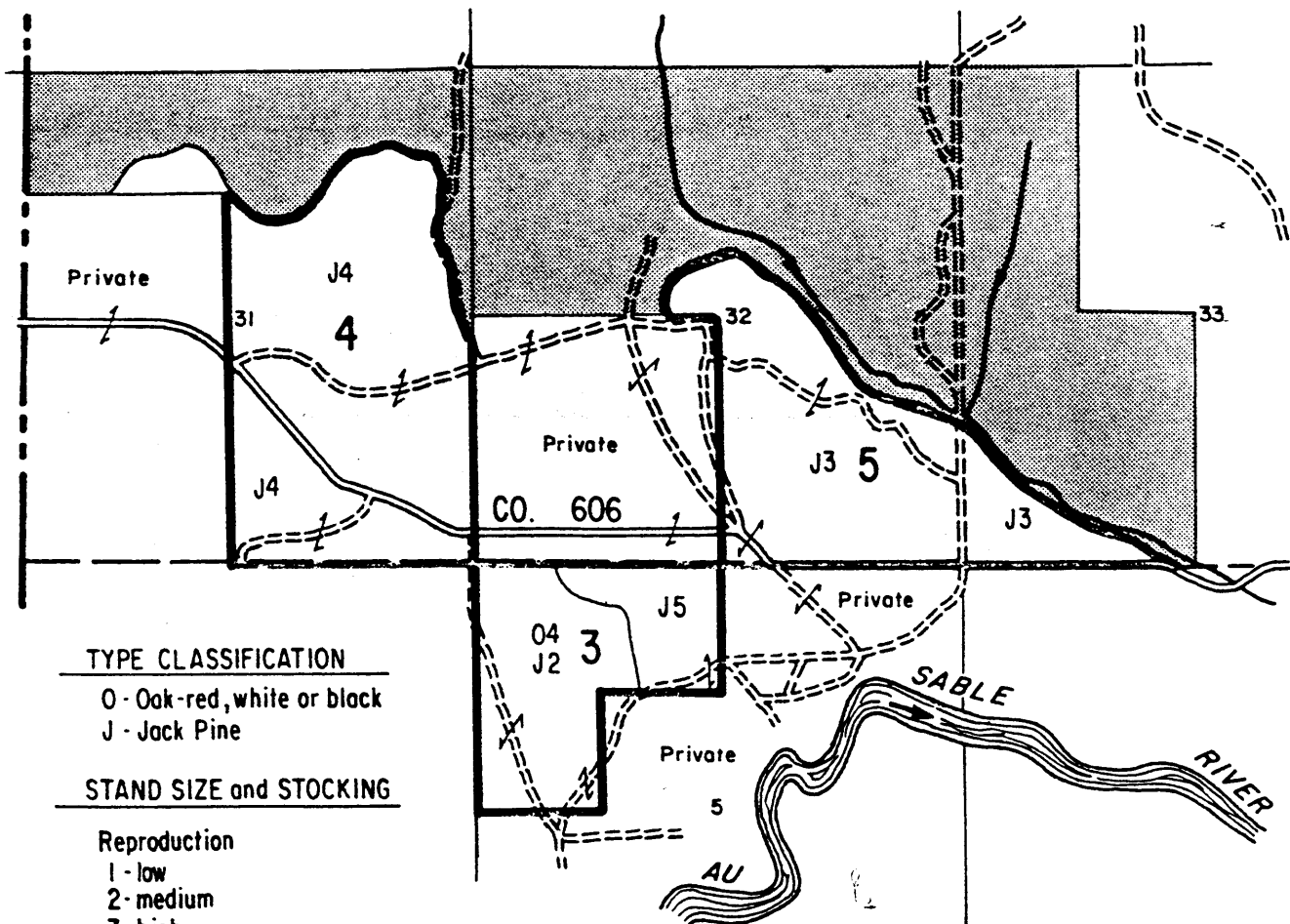
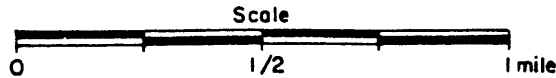
IOSCO COUNTY, MICH.

1978



# WARBLER MONUMENT AREA KIRTLAND'S WARBLER MANAGEMENT UNIT

OSCODA COUNTY, MICHIGAN  
T26 and 27N, R1E



## TYPE CLASSIFICATION

O - Oak-red, white or black  
J - Jack Pine

## STAND SIZE and STOCKING

### Reproduction

1 - low  
2 - medium  
3 - high

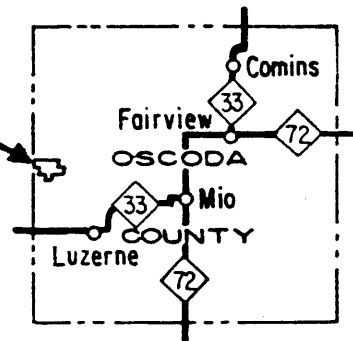
### Pole Timber

4 - low  
5 - medium  
6 - high

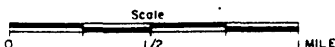
NOT WARBLER HABITAT

MARGINAL HABITAT

WARBLER MONUMENT AREA  
KIRTLAND'S WARBLER  
MANAGEMENT UNIT



T26N, R3W



TYPE CLASSIFICATION




O - Oak-red, white or black  
J - Jack Pine  
R - Red Pine  
G - Upland Grass

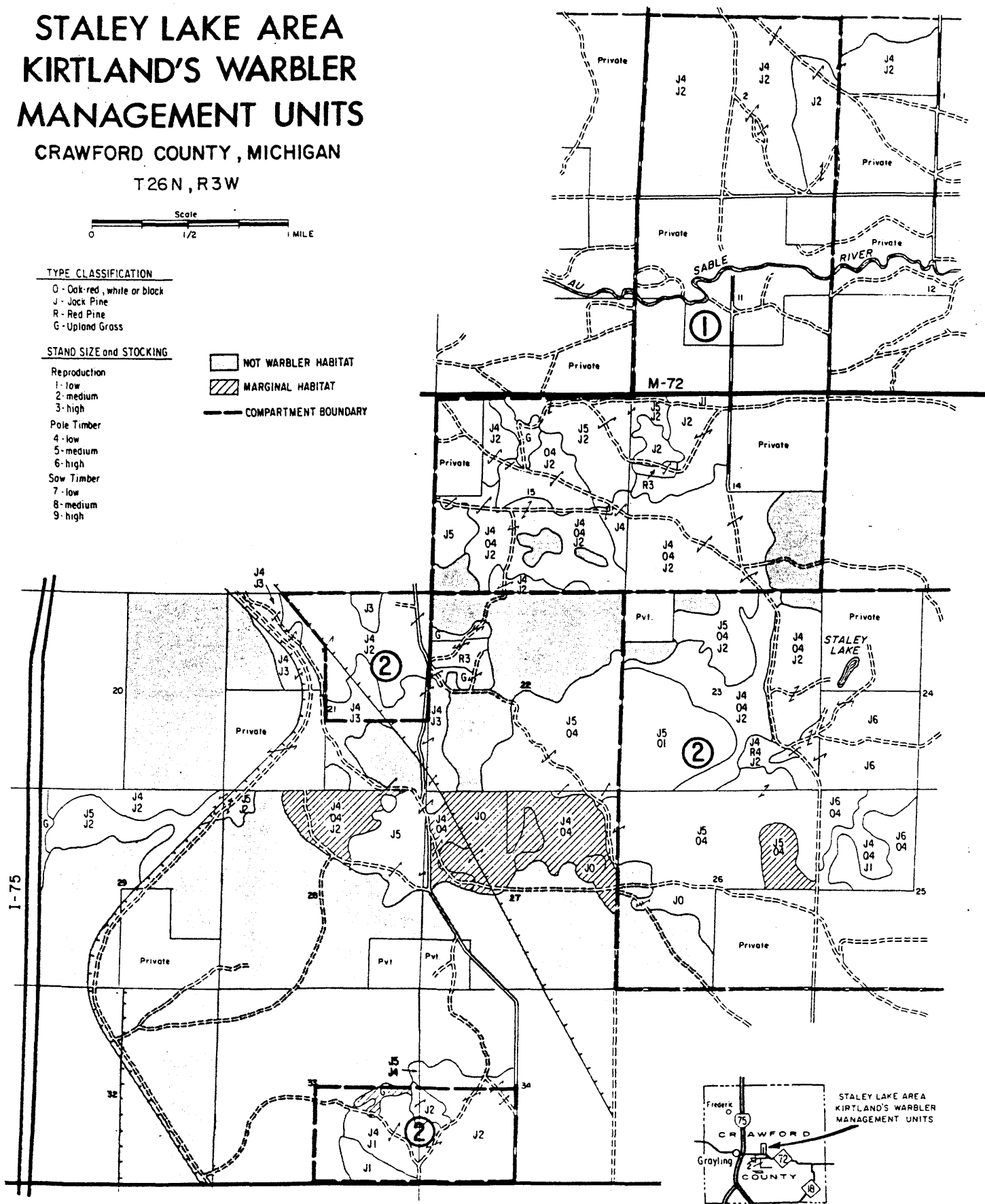
### STAND SIZE and STOCKING

Reproduction  
1 - low  
2 - medium  
3 - high

Pole Timber  
4 - low  
5 - medium  
6 - high

Sow Timber  
7 - low  
8 - medium  
9 - high

 NOT WARBLER HABITAT  
 MARGINAL HABITAT  
 COMPARTMENT BOUNDARY

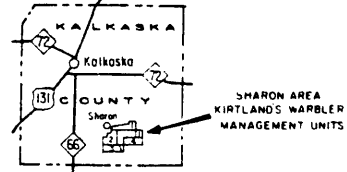




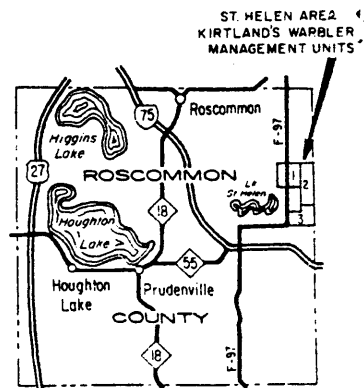
# SHARON AREA KIRTLAND'S WARBLER MANAGEMENT UNITS

Scale

0 1/2 1 MILE

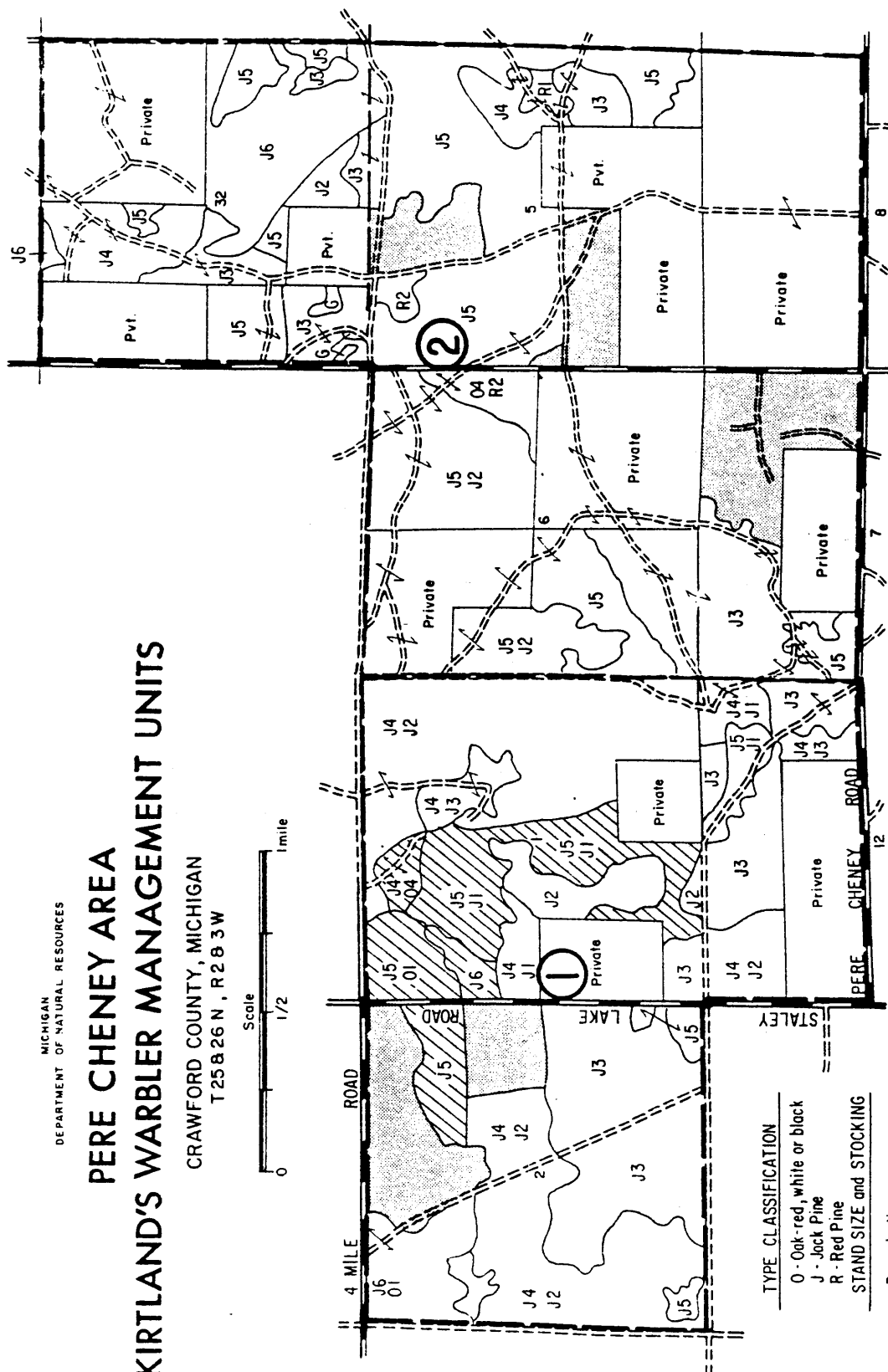


T 23 N , R I W



# PERE CHENEY AREA KIRTLAND'S WARBLER MANAGEMENT UNITS

CRAWFORD COUNTY, MICHIGAN  
T 25 B 26 N, R 2 B 3 W



**TYPE CLASSIFICATION**  
O - Oak-red, white or black  
J - Jack Pine  
R - Red Pine  
**STAND SIZE and STOCKING**

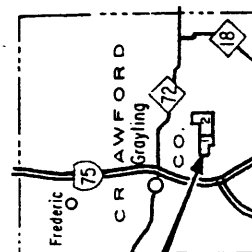
**Reproduction**

- 1 - low
- 2 - medium
- 3 - high
- Pole Timber
- 4 - low
- 5 - medium
- 6 - high

NOT WARBLER HABITAT

MARGINAL HABITAT

COMPARTMENT BOUNDARY



PERE CHENEY AREA  
KIRTLAND'S WARBLER  
MANAGEMENT UNIT



T27N,RIW

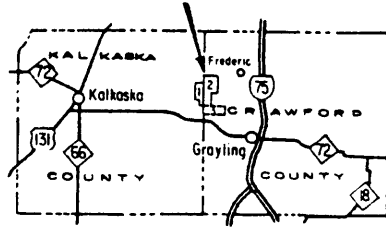


T 27 N , R 1 and 2 E

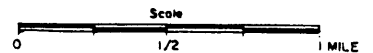
# MANISTEE RIVER AREA KIRTLAND'S WARBLER MANAGEMENT UNITS

KALKASKA & CRAWFORD CO'S., MICH.  
T 27 N, R 4 & 5 W

MANISTEE RIVER AREA  
KIRTLAND'S WARBLER  
MANAGEMENT UNITS



MICHIGAN  
DEPARTMENT OF NATURAL RESOURCES



## TYPE CLASSIFICATION

J - Jack Pine  
O - Oak - red, white or black  
R - Red Pine  
G - Upland Grass  
U - Upland Brush

## STAND SIZE and STOCKING

### Reproduction

1 - low  
2 - medium  
3 - high

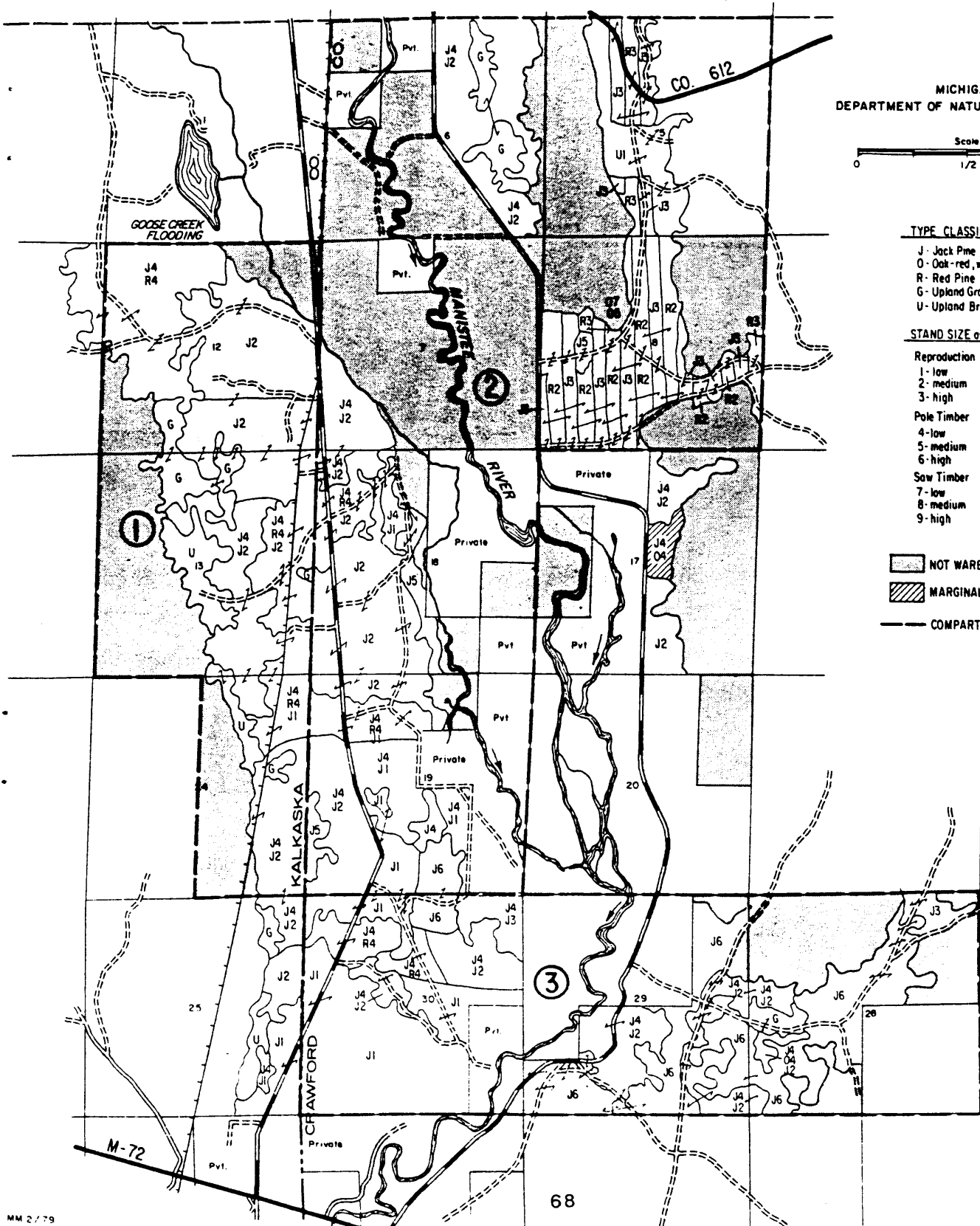
### Pole Timber

4 - low  
5 - medium  
6 - high

### Saw Timber

7 - low  
8 - medium  
9 - high

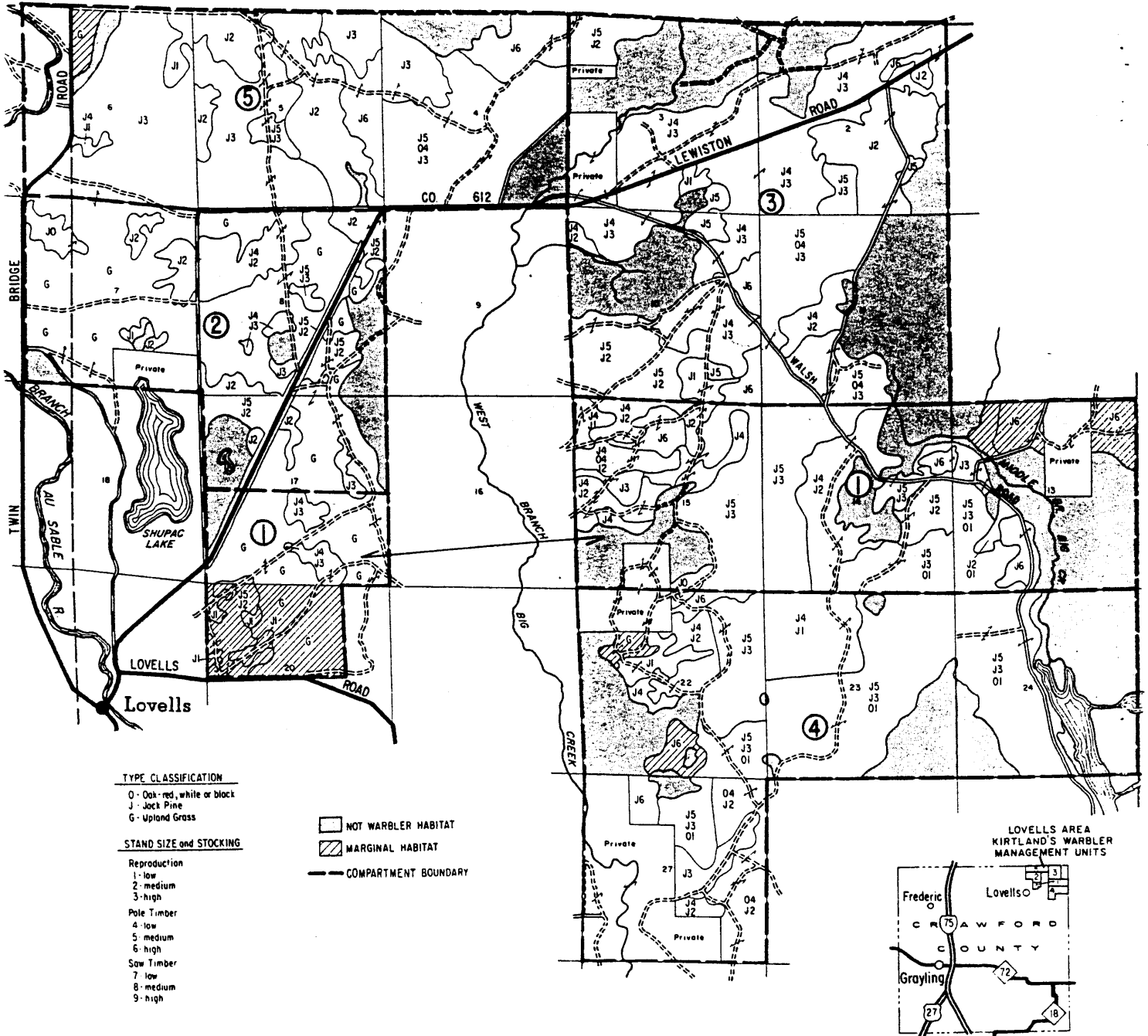
- NOT WARBLER HABITAT
- MARGINAL HABITAT
- COMPARTMENT BOUNDARY



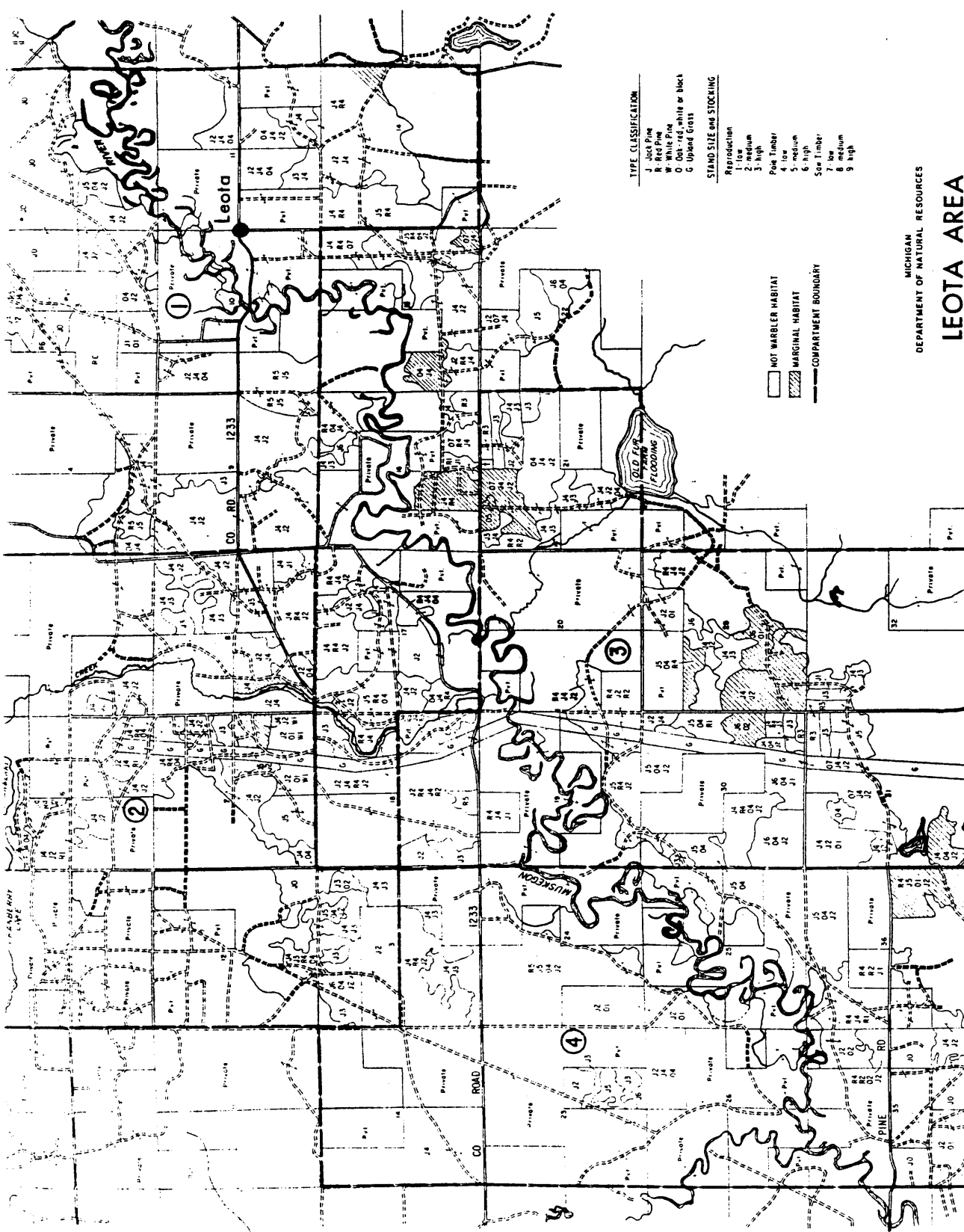
# LOVELLS AREA KIRTLAND'S WARBLER MANAGEMENT UNITS

CRAWFORD COUNTY, MICHIGAN  
T 28 N, R 1 and 2 W

Scale  
0 1/2 1 MILE







- TYPE CLASSIFICATION**
- J Jack Pine
  - W White Pine
  - W Red Pine
  - O Oak - red white or black
  - G Upland Grass
- STAND SIZE and STOCKING**
- Reproduction
- 1 - low
  - 2 - medium
  - 3 - high
- Pool Timber
- 4 - low
  - 5 - medium
  - 6 - high
- See Timber
- 7 - low
  - 8 - medium
  - 9 - high

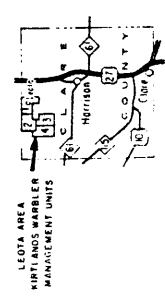
- NOT WARBLER HABITAT
- ▨ MARGINAL HABITAT
- COMPARTMENT BOUNDARY

MICHIGAN  
DEPARTMENT OF NATURAL RESOURCES

## LEOTA AREA

### KIRTLAND'S WARBLER MANAGEMENT UNITS

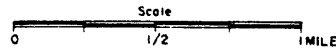
CLARE COUNTY, MICHIGAN  
T20N, R58.6W



# FLETCHER ROAD AREA KIRTLAND'S WARBLER MANAGEMENT UNITS

KALKASKA and CRAWFORD COUNTIES, MICHIGAN

T 25 N, R 4 and 5 W



## TYPE CLASSIFICATION

A - Aspen, White Birch  
O - Oak - red, white or black  
J - Jack Pine  
R - Red Pine  
G - Upland Grass

NOT WARBLER HABITAT

MARGINAL HABITAT

COMPARTMENT BOUNDARY

## STAND SIZE and STOCKING

### Reproduction

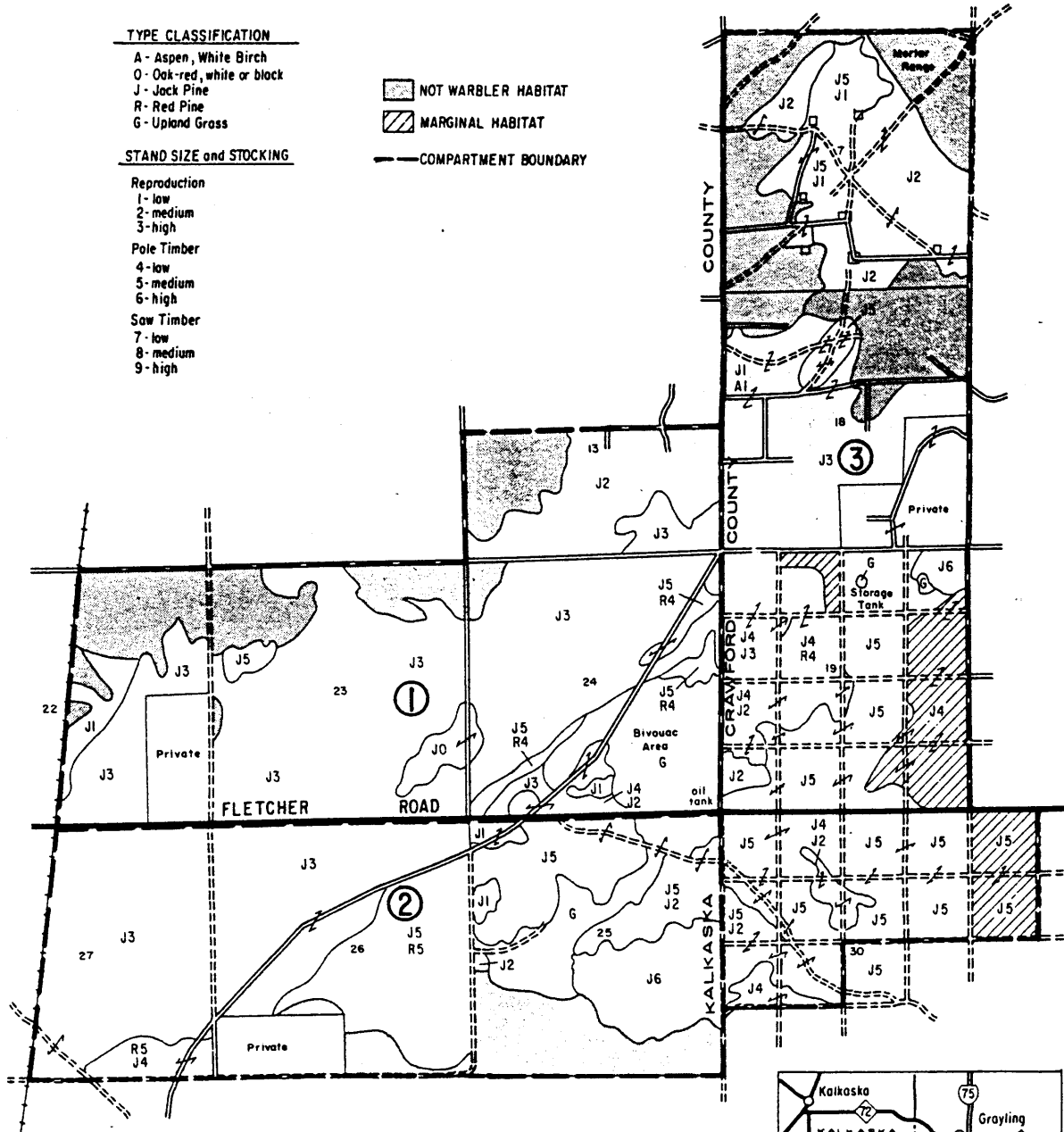
1 - low  
2 - medium  
3 - high

### Pole Timber

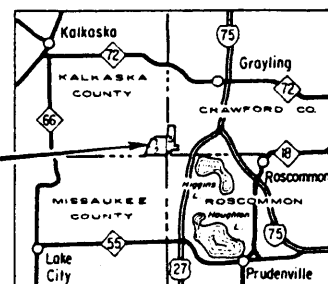
4 - low  
5 - medium  
6 - high

### Saw Timber

7 - low  
8 - medium  
9 - high



FLETCHER ROAD AREA  
KIRTLAND'S WARBLER  
MANAGEMENT UNITS





**DAMON AREA  
KIRTLAND'S WARBLER MANAGEMENT UNITS  
OGEMAW COUNTY, MICHIGAN**

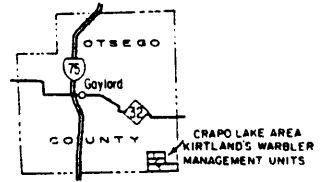
MICHIGAN  
DEPARTMENT OF NATURAL RESOURCES

# CRAPO LAKE AREA KIRTLAND'S WARBLER MANAGEMENT UNITS

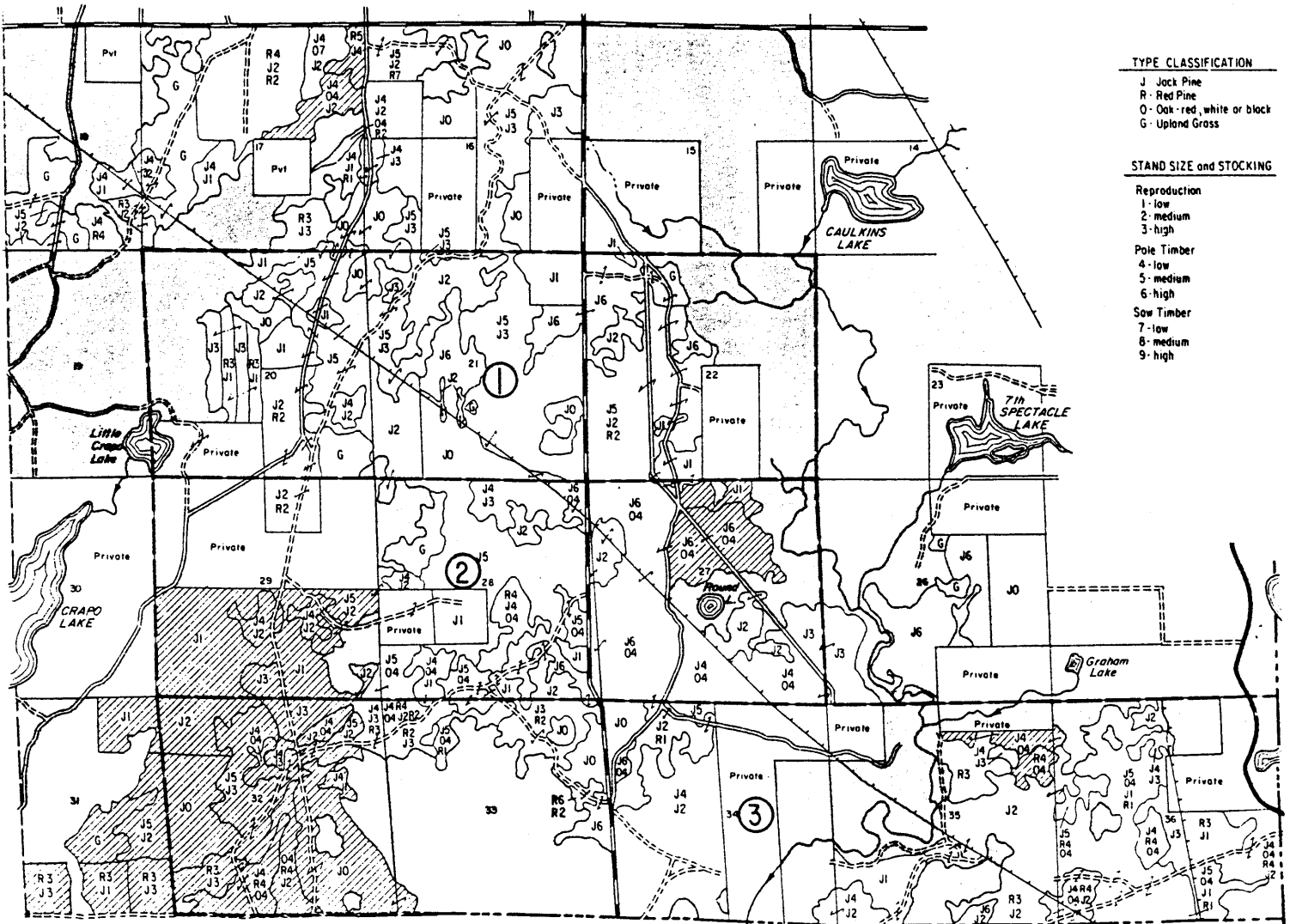
OTSEGO COUNTY, MICHIGAN

T29N, R1W

NOT WARBLER HABITAT  
MARGINAL HABITAT  
COMPARTMENT BOUNDARY

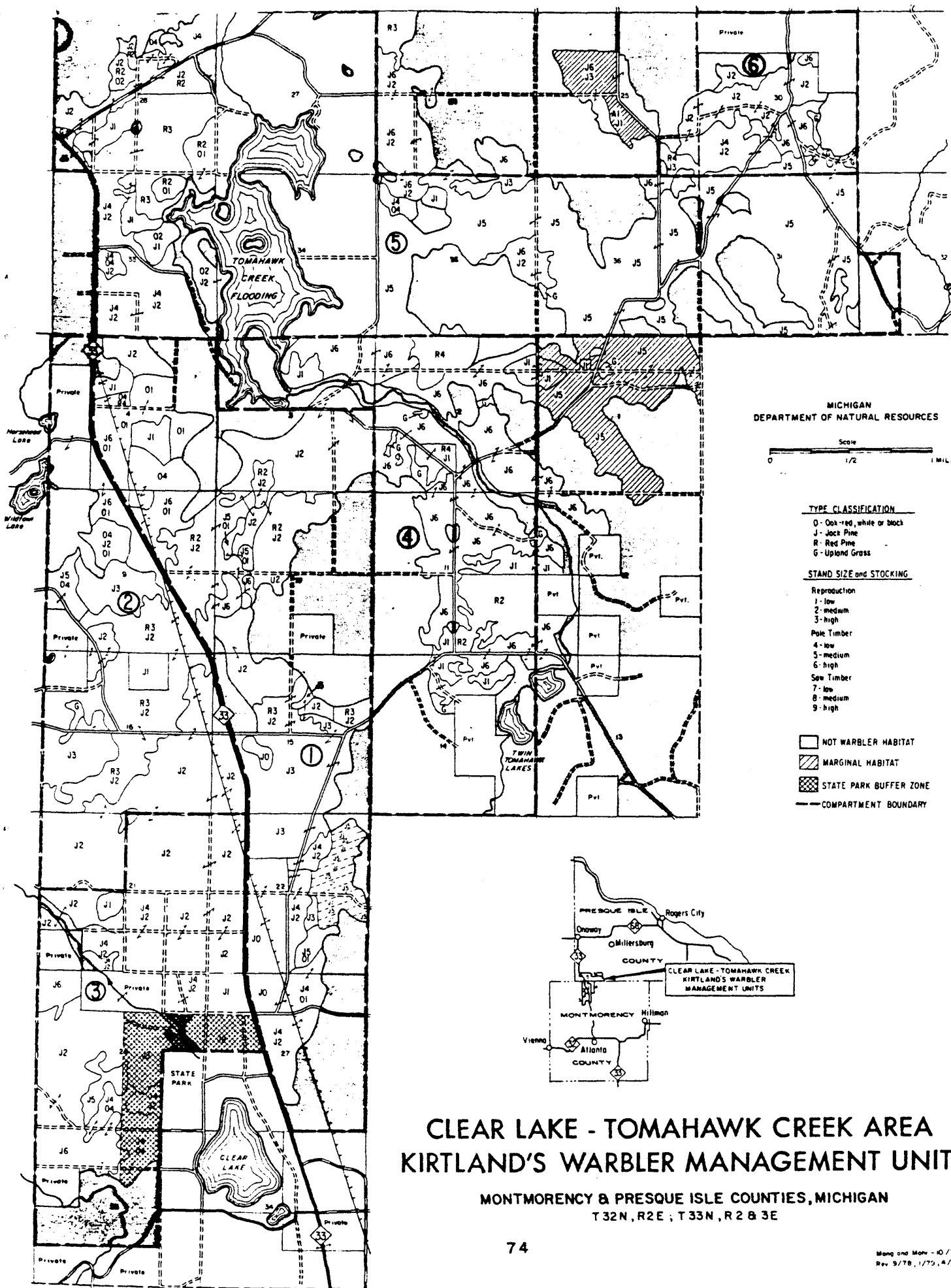


Scale  
0 1/2 1 MILE



TYPE CLASSIFICATION  
J - Jack Pine  
R - Red Pine  
O - Oak - red, white or black  
G - Upland Grass

STAND SIZE and STOCKING  
Reproduction  
1 - low  
2 - medium  
3 - high  
Pole Timber  
4 - low  
5 - medium  
6 - high  
Saw Timber  
7 - low  
8 - medium  
9 - high



# BIG CREEK AREA KIRTLAND'S WARBLER MANAGEMENT UNITS

Scale

0  $\frac{1}{2}$  1 MILE



O - Oak-red, white or black  
J - Jack Pine  
R - Red Pine  
G - Upland Grass

### STAND SIZE and STOCKING

**Reproduction**  
1 - low  
2 - medium  
3 - high

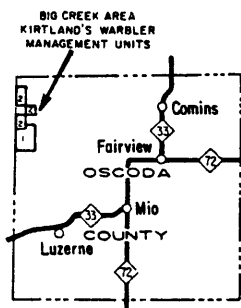
**Pole Timber**  
4 - low  
5 - medium  
6 - high

Saw Timber  
7 - low  
8 - medium  
9 - high

☐ NOT WARBLER HABITAT

 MARGINAL HABITAT

COMPARTMENT BOUNDARY



## APPENDIX D

DESIRABLE HABITAT FOR ACQUISITION

Attempts will be made to purchase the following private land inholdings within or adjacent to essential habitat, provided owners wish to sell, funds are available for such purchases, and the parcels can be obtained at fair market value. No condemnation proceedings are envisioned.

A. U.S. FISH AND WILDLIFE SERVICE LIST

<u>County</u>	<u>Management Area</u>	<u>Description</u>	<u>Acres</u>
Clare	Leota	✓T20N R5W, Sec 3 SW1/4 of NE1/4	<del>40</del>
Clare	Leota	✓T20N R5W, Sec 3 NW1/4 of SE1/4	<del>40</del>
Clare	Leota	- ✓T20N R5W, Sec 9 S 1/2 of NE1/4; E1/2 of NE1/4 of NE1/4	100 M
Clare	Leota	- ✓T20N R5W, Sec 18 E1/2 of NW1/4	<del>80</del>
Clare	Leota	- ✓T20N R5W, Sec 22 NW1/4 of NE1/4	40 M
Clare	Leota	- ✓T20N R5W, Sec 30 E1/2 of NW1/4	80 H
Clare	Leota	- ✓T20N R5W, Sec 30 NW1/4 of SE1/4	40 H
Clare	Leota	- ✓T20N R6W, Sec 14 S1/2 of SE1/4 parts owned	80 H
Clare	Leota	- ✓T20N R6W, Sec 23 E1/2 of NW1/4	<del>80</del>
Clare	Leota	- ✓T20N R6W, Sec 24 NW1/4 of NE1/4 ~ 10 ac owned	40 M
Clare	Leota	- ✓T20N R6W, Sec 35 SW1/4 of NE1/4	40 L
Clare	Leota	- ✓T20N R6W, Sec 35 SE1/4 of NW1/4	40 L
Clare	Leota	- ✓T20N R6W, Sec 35 NE1/4 of SW1/4	40 L
Clare	Leota	- ✓T20N R6W, Sec 35 NW1/4 of SE1/4	40 M
Crawford	Lovells	✓T28N R1W, Sec 13 NW1/4 of NE1/4	40 M
Crawford	Pere Cheney	✓T25N R2W, Sec 5 W1/2 of SE1/4, part	20 L
Crawford	Pere Cheney	✓T25N R2W, Sec 6 SE1/4 of NW1/4 ~ 20 ac owned	40 H
Crawford	Pere Cheney	✓T25N R3W, Sec 1 NW1/4 of SW1/4	40? 20 H
Crawford	Pere Cheney	✓T25N R3W, Sec 1 N1/2 of SW1/4 of SW1/4	20 H
Crawford	Pere Cheney	✓T26N R2W, Sec 32 NE1/4, part all but 10 ac owned	90 M
Crawford	Pere Cheney	✓T26N R2W, Sec 32 SE1/4 of SW1/4	40 H
Crawford	Staley Lake	✓T26N R3W, Sec 1 SW1/4	160 M
Crawford	Staley Lake	✓T26N R3W, Sec 34 SE1/4 own NW1/4 of SE1/4	160 L
Kalkaska	Fletcher Road	✓T25N R5W, Sec 22 E1/2 of SE1/4	80 H
Kalkaska	Sharon	✓T25N R6W, Sec 8 SW1/4 of SW1/4	40 M
Kalkaska	Sharon	✓T26N R6W, Sec 35 SE1/4	160 M
Montmorency	(Clear Lake- Tomahawk Creek	✓T32N R2E, Sec 12 NW1/4 of SW1/4	40 L
Ogemaw	Damon	✓T23N R2E, Sec 6 SW1/4 of NE1/4	40 M
Ogemaw	Damon	✓T24N R1E, Sec 1 NE1/4	160 L
Ogemaw	Damon	✓T24N R1E, Sec 5 N1/2 of SE1/4	80 X

## A. U.S. FISH AND WILDLIFE SERVICE LIST

County	Management Area	Description	Acres
Ogemaw	Damon	✓T24N R1E, Sec 5 SW1/4 of NW1/4 2000 owned (N)	20 40 L
Ogemaw	Damon	✓T24N R1E, Sec 14 NW1/4	160 H
Ogemaw	Damon	✓T24N R1E, Sec 14 SW1/4 of SW1/4	40 H
Ogemaw	Damon	✓T24N R1E, Sec 17 NW1/4, part	20 60 H
Ogemaw	Damon	✓T24N R1E, Sec 17 SE1/4 of NE1/4	20 40 H
Ogemaw	Damon	✓T24N R1E, Sec 18 N1/4 of NE1/4	80 M
Ogemaw	Damon	✓T24N R1E, Sec 26 NW1/4	160 M
Ogemaw	Damon	✓T24N R1E, Sec 34 NW1/4 of NE1/4	40 H
Ogemaw	Damon	✓T24N R1E, Sec 34 N1/2 of SW1/4 of NE1/4	20 H
Ogemaw	Damon	✓T24N R1E, Sec 35 NW1/4 - 3000 owned - 2000 owned - 1000 owned	160
Ogemaw	Damon	✓T24N R1E, Sec 36 S1/2 of NE1/4	80 M
Ogemaw	Damon	✓T24N R2E, Sec 3 SW1/4 of NW1/4	40 M
Ogemaw	Damon	✓T24N R2E, Sec 3 SW1/4 - 1600 owned	160 M
Ogemaw	Damon	✓T24N R2E, Sec 6 E1/2 of NW1/4	80 M
Ogemaw	Damon	✓T24N R2E, Sec 18 SE1/4 of SE1/4 of NE1/2	10 L
Ogemaw	Damon	✓T24N R2E, Sec 18 NE1/4 of SE1/4 of NE1/2	120
		S1/2 of SE1/4 - 1000 owned	20 L
Ogemaw	Damon	✓T24N R2E, Sec 29 W1/2 of NW1/4	80
Ogemaw	Damon	✓T24N R2E, Sec 30 NE1/4	160 H
Ogemaw	Damon	✓T24N R2E, Sec 31 SE1/4 of NW1/4	40 L
Ogemaw	Damon	✓T24N R2E, Sec 32 SE1/4 of SW1/4	40 L
Ogemaw	Ogemaw Refuge	✓T23N R1E, Sec 17 SE1/4	160 H
Ogemaw	Ogemaw Refuge	✓T23N R1E, Sec 19 NW1/4	160 H
Ogemaw	Ogemaw Refuge	✓T23N R1E, Sec 20 NW1/4 of NW1/4	40 M
Ogemaw	Ogemaw Refuge	✓T23N R1E, Sec 20 W1/2 of SE1/4	80 H
Ogemaw	Ogemaw Refuge	✓T23N R1E, Sec 32 NE1/4 of NE1/4, part	21
Oscoda	Big Creek	✓T27N R1E, Sec 5 NW1/4 of SW1/4	40
Oscoda	Big Creek	✓T27N R1E, Sec 6 W1/2 part owned - 1000 owned - 1000 owned	260
Oscoda	Big Creek	✓T27N R1E, Sec 7 NW1/4 part owned - 1000 owned - 1000 owned	160
Oscoda	Big Creek	✓T28N R1E, Sec 18 SW1/4 of NE1/4	40
Oscoda	Muskrat Lake	✓T27N R1E, Sec 13 SW1/4 of SE1/4	40 L
Oscoda	Muskrat Lake	✓T27N R1E, Sec 23 E1/2 of SW1/4	80 M
Oscoda	Muskrat Lake	✓T27N R1E, Sec 23 NE1/4 of SE1/4	40 M
Oscoda	Warbler Monument	✓T26N R1E, Sec 5 N1/2 of NE1/4	80 M
Oscoda	Warbler Monument	✓T27N R1E, Sec 31 E1/2 of SW1/4	80 L
Oscoda	Warbler Monument	✓T27N R1E, Sec 31 SE1/4 of NW1/4	40 L
Oscoda	Warbler monument	✓T27N R1E, Sec 32 SW1/4 3000 owned	160 L
Otesego	Crapo Lake	✓T29N R1W, Sec 16 E1/2 of SW1/4	80 L
Roscommon	St. Helen	✓T23N R1W, Sec 24 E1/2 of SW1/4 own NE 1/4 - 1000 owned	40 80 L
TOTAL			5,241



B. USDA FOREST SERVICE LIST

<u>County</u>	<u>Management Area</u>	<u>Description</u>	<u>Acres</u>
Alcona	McKinley	T27N R5E, Sec 31 SW1/4 of NW1/4, part	21
Crawford	Eldorado	T25N R1W, Sec 11 E1/2 of SW1/4	40
Crawford	Pere Cheney	T25N R2W, Sec 16 N1/2 of NE1/4	80
Crawford	Pere Cheney	T26N R2W, Sec 34 SW1/4 of SW1/4	40
Iosco	Tawas	T22N R7E, Sec 4 SE1/4 of NW1/4	40
Iosco	Tawas	T22N R7E, Sec 4 NE1/4 of SE1/4	40
Iosco	Tawas	T23N R6E, Sec 12 SW1/4 of SW1/4	40
Iosco	Tawas	T23N R7E, Sec 10 SE1/4 of SW1/4	40
Oscoda	Big Creek	T25N R1E, Sec 11 SE1/4 of SE1/4	40
Oscoda	Big Creek	T25N R1E, Sec 11 SE1/4 of NW1/4	40
Oscoda	Big Creek	T25N R1E, Sec 26 SE1/4 of NW1/4	40
Oscoda	Big Creek	T25N R2E, Sec 20 W1/2 of SE1/4	80
Oscoda	Big Creek	T25N R2E, Sec 32 N1/2 of NW1/4	80
Oscoda	Mack Lake	T25N R3E, Sec 4 NW1/4 of SW1/4	40
Oscoda	Mack Lake	T25N R3E, Sec 4 Lot 2	35
Oscoda	Mack Lake	T25N R3E, Sec 5 S1/2	320
Oscoda	Mack Lake	T25N R3E, Sec 8 SW1/4	150
Oscoda	McKinley	T26N R3E, Sec 2 N1/2 of SE1/4	40
Oscoda	McKinley	T26N R3E, Sec 3 W1/2 of NE1/4	80
Oscoda	McKinley	T26N R3E, Sec 3 NE1/4 of NE1/4	40
Oscoda	McKinley	T26N R3E, Sec 3 W1/2 of SE1/4 of NE1/4	20
Oscoda	McKinley	T26N R3E, Sec 12 N1/2 of N1/2	160
TOTAL			1,468





**RECEIVED**  
JUN 18 2005  
FMFMD

